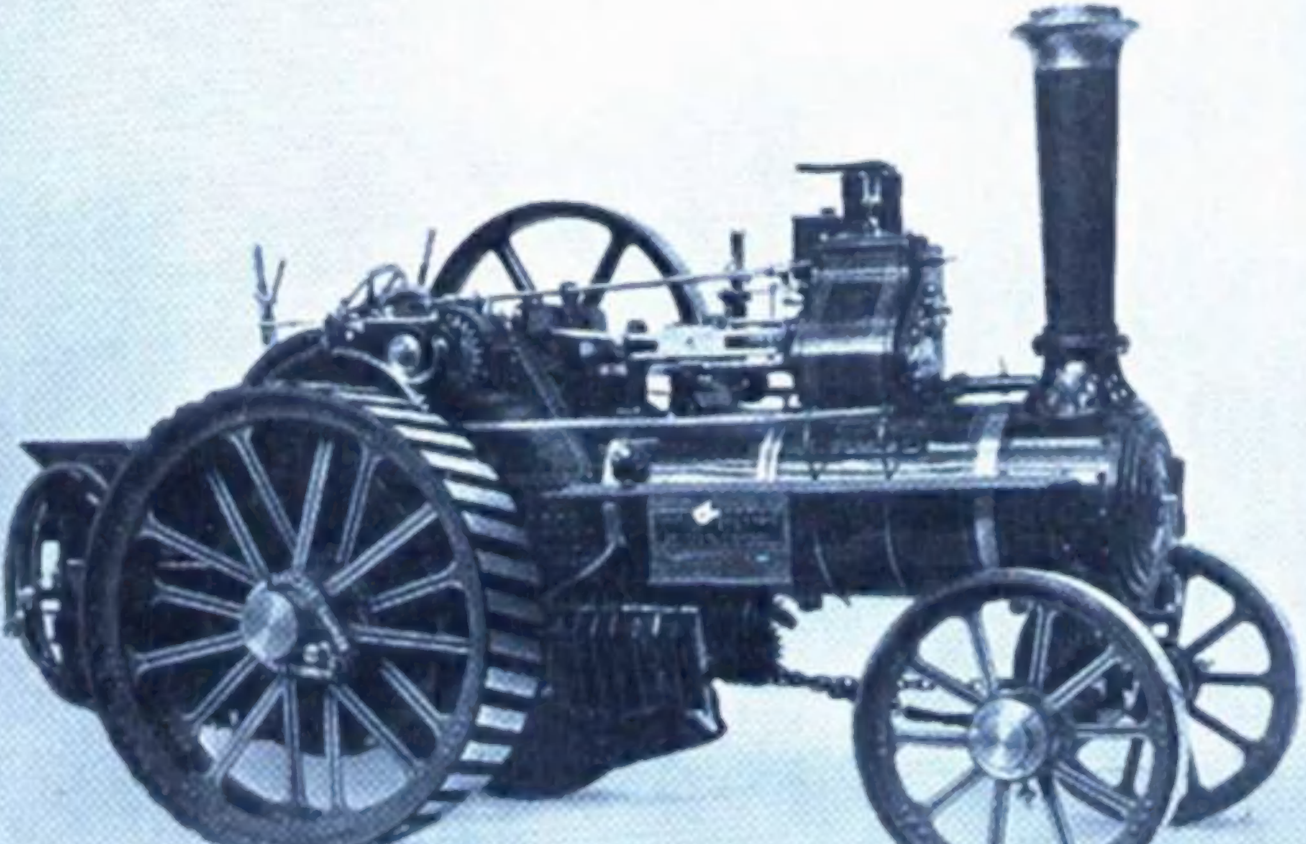
THE MODEL ENGINEER



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EVERY THURSDAY

THE MODEL ENGINEER

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Our Cover Picture

Among the prize-winning entries for the "M.E." Exhibition, Competition section, last year, was the very excellent 1½-in. scale Burrell single-crank compound "Devonshire" engine seen in the photograph reproduced on our cover this week. It was built by Mr. E. W. Balson, of Southampton, who is well known as an enthusiast for steam road locomotives, and it is his latest model.

The main idea behind the construction of this engine was to reproduce the prototype as closely as possible, and the model is highly successful in this respect. At the same time, it is a powerful unit when under steam, which shows once more that there is little reason why a nice true-to-scale appearance should be sacrificed in the interests of working.

The prototype was the most popular of Burrell's single-crank compound engines; it first appeared about 1900, and many examples were built between then and 1919, after which it seems to have been largely superseded by the double-crank compound engine of greater power.

SMOKE RINGS

An Eye for Detail!

THE KEEN powers of observation possessed by our readers is proved by many comments we have received on the subject of our cover picture for the January 1st issue. While our correspondents all agree that it is an excellent illustration of a model engineer at work, they raise a very practical criticism regarding the loose tie worn by the operator, which, as they quite rightly point out, is a potential source of danger to anyone operating a machine tool of any kind. This was not altogether a surprise to us as we had anticipated some comment on the subject, and we acknowledge the soundness of the advice that loose clothing of any kind should be avoided in the workshop wherever possible; but what we did not anticipate was that such a swarm of readers should descend on us like an avalanche in calling attention to such a detail! The picture as a whole was so typical of the subject it purports to represent that we hope and trust that readers will forgive its apparent condonation of neglecting an elementary safety precaution.

Preparations Beginning

WE HAVE received a letter from Mr. R. Pemble, hon. secretary of the Andover and District Model Engineering Society, who tells us that, at Easter next, his society will not be holding the usual exhibition of models; instead, a "Live Steam" day is to be organised. This event is to take the form of a traction engine rally, together with provision of 7¼-in. and 3½-in. gauge track for what Mr. Pemble describes as "the smaller variety of mobile power plants."

The Andover society is fortunate in being able to have the use of a field with water laid on and a car park; in addition, there are facilities for refreshments of all kinds. Details of the events are yet to be worked out, but they should certainly be grand entertainment for lovers of the steam locomotives of road and rail. Mr. Pemble would welcome any suggestions.

So far as we are aware, this will be an entirely novel enterprise for a model engineering society to organise. We know that road locomotives were present at certain open-air meetings held by model engineering societies last year; but we do not think that there was ever more than one locomotive per meeting, and we applaud the Andover scheme. No doubt, we shall be advised of final arrangements when they have been decided; meanwhile, if anyone has any suggestions to make, he should advise Mr. R. Pemble, 14, Weyhill Road, Andover.

Talyllyn Train Service

FOR THE first time for many years, The Talyllyn Railway is operating a passenger service during the winter months, although it is being run on Fridays only as an experiment. The service is intended to give facilities for shopping in Towyn to inhabitants of isolated farms and houses up the valley and runs between Pendre (Towyn) and Brynglas only. On Fridays the train leaves Brynglas at 12.30 p.m., calls at Rhydyronen at 12.40 p.m. and reaches Pendre at 12.55 p.m The return time from Pendre is 3.15 p.m. The trains are light and are worked by No. 4 or by the latest addition to the rolling stock, No. 5, which is an internal-combustion locomotive made up of a Ford engine mounted on a sprung wagon-chassis. The trains are worked in with construction and ballast trains taking staff to and from work on the track and passengers are conveyed on the up journey at about 9.30 a.m. from Pendre by arrangement; goods and merchandise are also conveyed. This also applies to the return timing from Brynglas at 3.45 p.m., when the train travels back to the shed at Pendre. The population in this area is sparse, but the trains have proved to fill a public need and will be continued throughout the winter if still patronised. Although there is only one intermediate station, it should be noted that stops are made at various halts by request, these being Hendy, Fach Goch, Cynfal and Tyn-y-Llwyn, all isolated from other facilities.

A simple high-pressure spray gun

By B. Terry Aspin

An article describing the construction of a practical appliance which can be made in the home workshop for very small cost

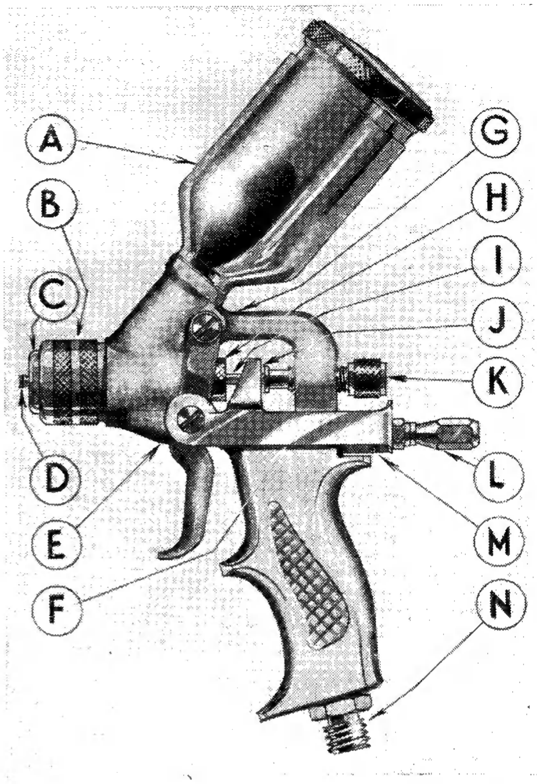


Fig. 2. A—Colour cup; B—Locking ring; C—Nozzle; D—Jet; E—Stirrup hinge; F—Stirrup; G—Trigger hinge; H—Paint gland; I—Needle; J—Clearance; K—Needle adjustment-screw and sleeve; L—Air-valve adjustment-screw and lock-nut; M—Air gland; N—Air-line adaptor. (¼ in. gas or B.S.P.)

THE following article on this small capacity spray-gun is offered without excuses. I admit that it could be regarded as a scaled-down copy of a popular product already on the market, but it has some differences which simplify its production on a 3½-in. lathe and, I believe, bring it within the scope of the quite modest workshop. Duly completed, it will prove a very useful addition to the equipment, and the cost is negligible, while the castings are within the capacity even of the kitchen fire.

Materials Required.

(a) A few inches of round and hex. brass rod about ⅜ in. dia. or across flats as the case may be.

(b) Six inches of stainless-steel ⅛ in. dia. Brass or bronze for second choice.

(c) Four 4-B.A. screws.

(d) A very short length of 1-in. dia. brass or bronze bar.

(e) A pound or two of aluminium scrap.

(f) Six by one and a half inches sheet stainless-steel or brass about 30 thou. thick.

For machining on a 3½ in. lathe a few special tools are required, all of which are well within the capabilities of the average worker and can be simply produced from silver-steel as required. Such items will be described as the need for them arises.

The Patterns

The first job to be tackled is the pattern-making and, as regards the gun itself, all that is required is a piece of softwood ⅝ in. thick. From this the main body can be jig-sawed as an oddside, which is really quite simple to mould but, if a better job is required, or if wood of only half the thickness is available, well then make it in the form of a split pattern and reap the benefit and advantages of easy moulding.

The outline is, first of all, cut out less nose and the base for the colour cup. For the former a separate disc, 1¼ in. dia., is cut from the same material and secured with glue and a carpenter's pin. The latter requires to be turned from, say, broom handle or similar and secured in the same way. The only other feature to be added is the boss to take the trigger and, although this could be built up with the plastic wood, perhaps the best recommendation would be for the location to be drilled ⅜ in. and transfixed with a peg turned to the same diameter (dowel would do). (Fig. 1.)

All that now remains is for the pistol-grip and other parts to be carved to the sections shown and plastic wood applied to fill in smoothly, and radius off all the joints and angles.

Some of the heavier parts of light-alloy castings are apt to shrink and "dimple" due to the contraction of the metal on cooling and, although this may not be the recognised solution to the problem so raised, I offer this suggestion as, at least, an effective remedy. The outstanding example on the pattern in hand is the nose. When cast, this requires to be an inch and a quarter in diameter and of *circular* section. But if it is made circular in the pattern, the casting, at best, will be flattened on the top side as poured, and any attempt to subsequently machine it will mean setting up off centre to compensate.

Having decided, therefore, which side uppermost the pattern will lay in the mould, add an extra eighth of an inch of plastic wood to the upper part of the nose, making it egg-shaped, and any other of the deeper sections can be treated in a similar manner.

Smooth down nicely with sand-paper, paying attention particularly to the parts of the pattern requiring to be drawn free from the sand. Any kind of paint will do but the writer prefers cellulose. It dries quickly and a really good surface can readily be obtained if first is used a spraying or brushing filler and, finally, a coat of gloss.

The same piece of wood will also provide the trigger. First jig-saw round the plan outline and finish off by carving to the elevation shown.

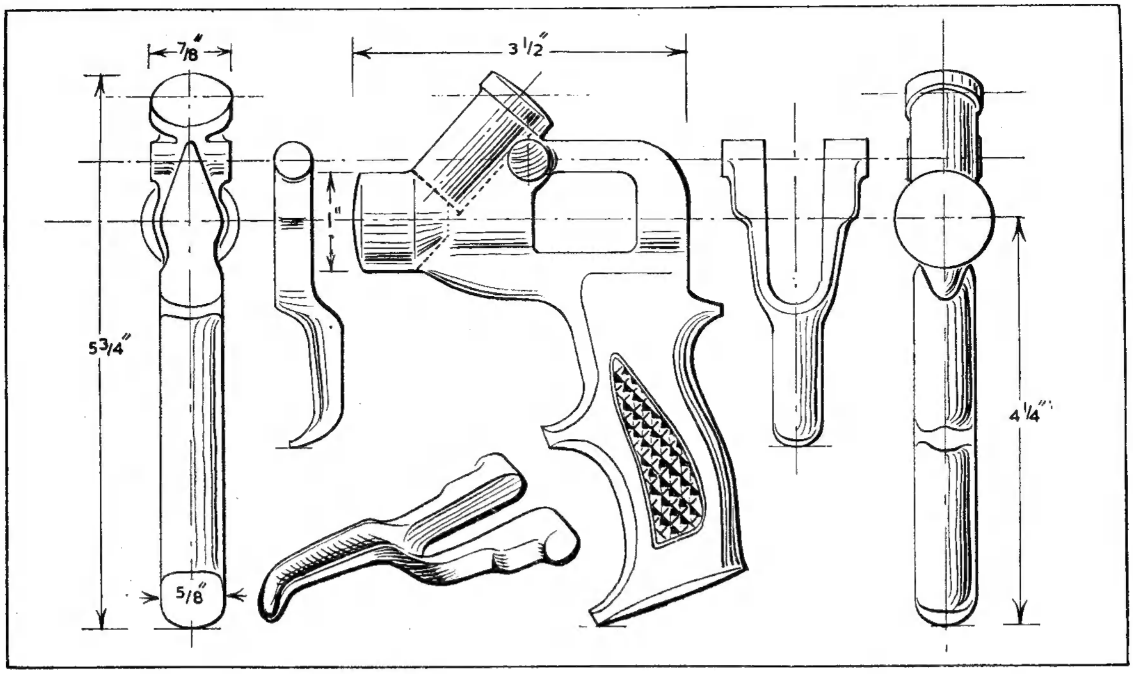


Fig. 1. Patterns for the gun body and the trigger. Dotted lines indicate the three pieces of wood used

The size of the pattern for the material cup was, in the case of the example shown, governed by the supply of suitable timber. On hand was the remains of what had been a domestic rolling pin about two inches in diameter and the pattern was turned from this. For painting models the capacity of a cup cast from such a pattern would be quite adequate but, of course, if one is contemplating the rejuvenation of the family four-seater or a project of equal ambition, a somewhat larger container for the paint would be an advantage.

The wood was chucked on a beheaded screw held in the three-jaw. It was found possible to hollow it out to a certain extent and, although, of course, a hollow casting is desirable here it is not to be regarded as advisable to be too drastic about it in this case. A baked core would solve the problem but if the pattern is intended to leave its own core in the mould it would be rather more than optimistic to make the inside to the full depth required. In any case, if the cup is cast vertically mouth uppermost, shrinkage will result in a core being left deeper than it is in the pattern. Incidentally, a substantial chucking-piece should be left at the base of the cup.

The pattern for the lid of the colour container is very simple. A plain disc with chucking-piece added will meet the case. A pattern of even greater simplicity will be required for the internally-threaded ring which screws on the nose of the gun to secure the nozzle. If, however, a piece of dural rod or tube of suitable dimension were available this may prove more satisfactory.

The Foundry Work

Aluminium can quite easily be cast in " green " or moist sand and, quite naturally, the finer the sand the better the finish. But no coal-dust is required or any other addition and, if the reader knows where there is a supply of fine sand in its natural state he can carry straight on

The four patterns from which the spray gun castings are made

with that. Even builders' sand can be used effectively. The writer is fortunate in having his abode within a few miles of a place where moulding sand is quarried and, recently, has acquired a nice quantity of it. As hewn it appears to be in the form of a very soft stone which must be broken down by grinding, but without any other treatment it has been used successfully for casting in iron, brass and aluminium.

If the pattern has been made as an oddside, the process of moulding the gun body can be assisted greatly by cutting out a rough outline of it from a piece of wood of about half the thickness. The pattern is placed inside this cut-out on the moulding board and the "drag" or bottom part of the box is rammed up in the usual way. Sift in the first layer of sand; it is well worth it; and the venting should not be forgotten before the box is inverted.

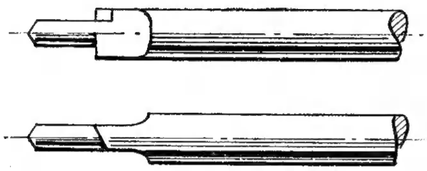
Turned over with the box, the cut-out can now be lifted off and the small quantity of superfluous sand left between it, and the pattern removed with a trowel to leave a neat, flat joint-face. There will also be a small core of sand where the pattern is pierced for the needle assembly and this should be allowed to remain.

Dust with parting sand or powder. Burned builders' sand is frequently used in foundries for parting, but there is a proprietary material marketed by suppliers to the industry which is really much more effective. The essential quality of such a powder seems to be that it should not readily absorb moisture.

Position the runner; a pretty hefty one is needed for aluminium; a short length of broom-stick is suggested, which should be inserted in the sand to the depth of about an inch. For the castings illustrated, the ingate was arranged to enter at the nose, but this is a matter which might be debatable as, sometimes, the portion of the casting nearest to it is subject to porosity or even dirt inclusions. The choice lies with the moulder, and experience will show, but foreign matter is not desirable in a casting anywhere at all and, as a lot of this latter trouble can be avoided by very careful skimming of the metal in the crucible prior to pouring, perhaps this would prove the logical answer.

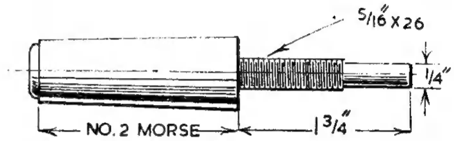
Add the top box or "cope," ram up as before and vent. Before splitting the mould for the removal of the pattern, draw out the stick to form the runner. By rotating it at the same time the hole will be formed conveniently funnel-shaped.

With reasonable care and good fortune the cope can now be lifted clear to reveal the pattern embedded in the sand of the drag. It can remain until the ingate has been cut to connect with the hollow formed by the base of the runner-stick and the sand immediately surrounding the pattern should be moistened to allow of a clean "draw."



Left—Fig. 3. Counterbore

Right—Fig. 4. Special centre



The trigger and, if it is decided to cast it, the nose locking-ring, could, of course, have conveniently been moulded in the same box. A 4 lb. (No. 2) crucible would hold more than sufficient metal to pour them all together.

Machining the Body

Before proceeding with the next operations, perhaps it would be as well to clean up both sides of the pistol grip by sanding or filing or by whatever means there is available. Rendered quite flat, this portion of the work will allow the casting to be mounted more securely in the vice or on the vertical slide and, for the first stage, that of boring for the needle and air valves, the work is gripped horizontally in the machine vice while that in turn is itself mounted on the vertical slide, the whole being arranged on the cross slide to bring the centre-line of the needle parallel with the bed. Other methods of setting-up will suggest themselves while, perhaps the use of an angle plate in lieu of the vertical slide would provide some advantage in the way of rigidity, the latter does allow of easier height adjustment.

For setting-up, mark out the centres of the needle assembly as closely as can be judged on the rough casting, and indent with a sharp punch, fore and aft. The two marks thus formed can be used as a guide. In fact the work can be thus supported temporarily between the lathe centres while the vice is negotiated into a suitable position on the vertical slide to clamp the casting, as before mentioned. The nose of the gun should be located on the back centre and the result should be a clean bore right through, particularly if the latter is allowed to remain until the pilot drilling is nearly completed, being fed forward with the saddle.

A ⅛-in. drill long enough to penetrate completely would be ideal for the job. A satisfactory substitute can be arranged by turning a spigot on the shank of a drill of normal length and mating it, with the aid of a spot of soft solder, with the end of a length of mild-steel or brass rod of the same diameter.

The drill is followed by a ¼-in. counter bore made from silver-steel. This has a ⅛-in. pilot to ensure that it enlarges the first drilling concentrically. (Fig. 3.) The rear portion of the casting which houses the needle adjustment-screw is thus bored ¼ in. right through. The boring is continued into the back of the nose to the depth of half an inch. The cross slide can then be manipulated to bring the appropriate location of the air-valve into position for drilling and the ⅛-in. drill applied again to the depth of an inch and a half and the counter-bore follows this for ⅞ in. Before removing the casting from the present set-up the back, where the two valve positions have been located, can be faced up with an end-mill.

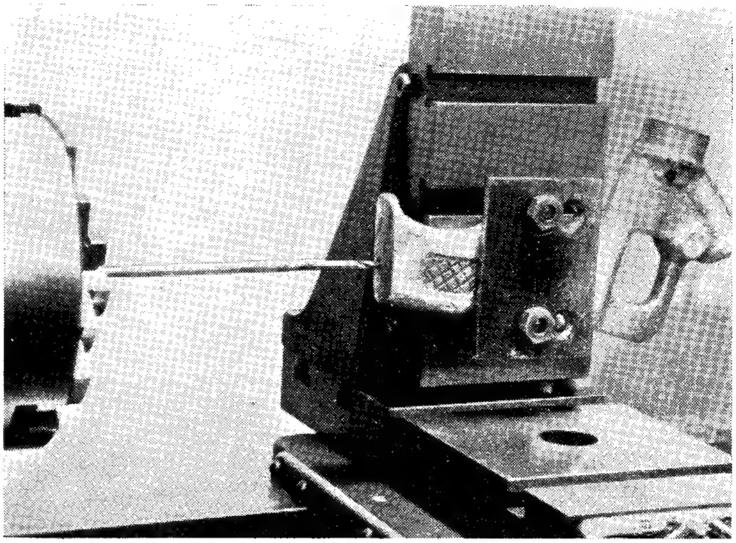
This leads to what is, perhaps, the most ticklish part of the work; the turning and screw-cutting of the gun nose. If this is to be carried out in the gap of a 3½-in. lathe a special centre for holding the work will be required. (Fig. 4.) It consists of a taper turned to suit the mandrel socket (in this case No. 2 Morse) terminating in a stub threaded $\frac{5}{16}$ in. × 26 t.p.i., and having a plain pilot, ¼ in. dia., at its extremity. The length of the stub should be 1⅝ in. but the threaded part need only be long enough to engage in the location of the needle adjusting-screw.

If a $\frac{5}{16}$ in. × 26 t.p.i. tap should be available the same could be used in preference to the rather tedious

occupation of making a silver-steel one for the job. There would, however, be the danger of the tap not entering truly. The special tap, on the other hand, is formed with a short pilot to guide it and, in practice, it did prove successful. It could be made now, while the lathe is set up for the 26 t.p.i. and it should be long enough to thread to the combined depth of both the needle adjustment-screw and the material gland, i.e., two inches.

For mounting on the special centre, however, it is desirable only to tap the location of the adjustment screw for the time being. The untapped material gland serves as a steady on the plain portion of the stub. It will now be possible to start the lathe and, using the drill chuck in the tailstock, feed a centre drill into the nose of the gun where the $\frac{1}{8}$-in. drill broke through. The work can now be fully supported between centres and the turning and screw-cutting carried out as normal. The drive obtained through the tapered centre alone will be found quite adequate for a light-alloy casting and, if a half-centre is employed in the tailstock, the nose can be faced without difficulty at the same setting.

The turning and screw-cutting completed, withdraw the half-centre from the tailstock and replace it with the drill chuck holding the $\frac{1}{4}$-in. counter-bore which should enter the nose to the depth of $\frac{3}{4}$ in. and, if the resultant hole can be conveniently tapped $\frac{5}{16}$ in. $\times$ 26 t.p.i. at this stage, so much the better. Before removing the work from the lathe the 45 degree seating for the jet should be formed. If the work runs truly unsupported by the back centre, this can be carried out with a sharp tool and a light cut.



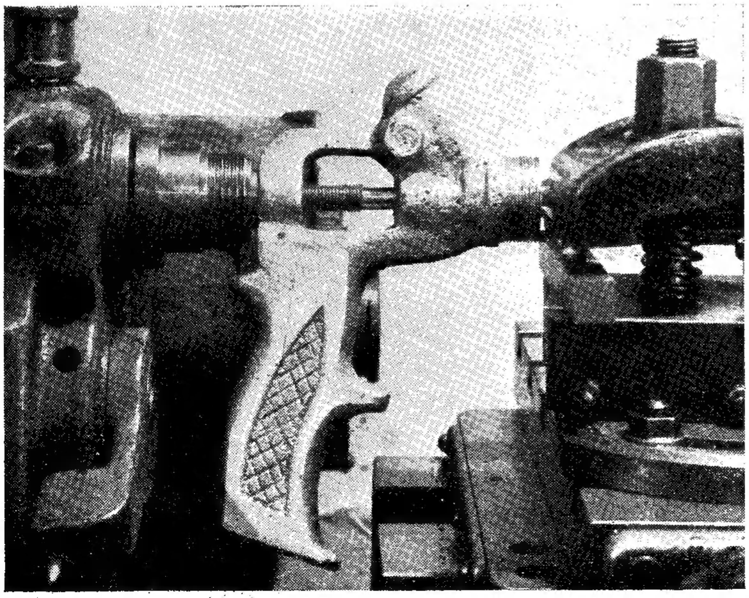
Applying the elongated $\frac{1}{8}$-in. drill

There is, of course, no absolute necessity for making universal use of the 26 t.p.i. thread like this, but the design was primarily adapted to enable the spray-gun to be produced in a workshop of quite modest equipment, and it was felt that standardisation of the threads would make for economy. Particularly if, as in the case of the original, the taps were to be an amateur product. The 26 t.p.i. was chosen because this appeared to offer about the finest thread which could safely be used on the cast aluminium.

To complete the work on the body of the gun, the drillings must now be made for the air ducts and for the colour passages. The vertical slide is again employed and the pistol-grip clamped directly to it. Care must be exercised to align the drill correctly. Particularly in the case of the duct which carries the air from the valve to the nozzle. For this the drill must enter the nose at an angle and break through into the extremity of the $\frac{1}{8}$-in. drilling already made from the back of the gun.

The air is introduced from the base of the pistol-grip and, for this, another drilling must be made right up the handle. The elongated $\frac{1}{8}$-in. drill will meet the case and it should break just abaft the valve-face as shown in the drawing. This drilling can be counter-bored, the depth is not critical, spot-faced and tapped in the one operation.

The final drilling is for the colour passage. It enters the top of the boss which carries the cup and connects with the jet socket, and is itself counter-bored and tapped to receive the screwed adaptor of the colour container. It is also spot-faced.



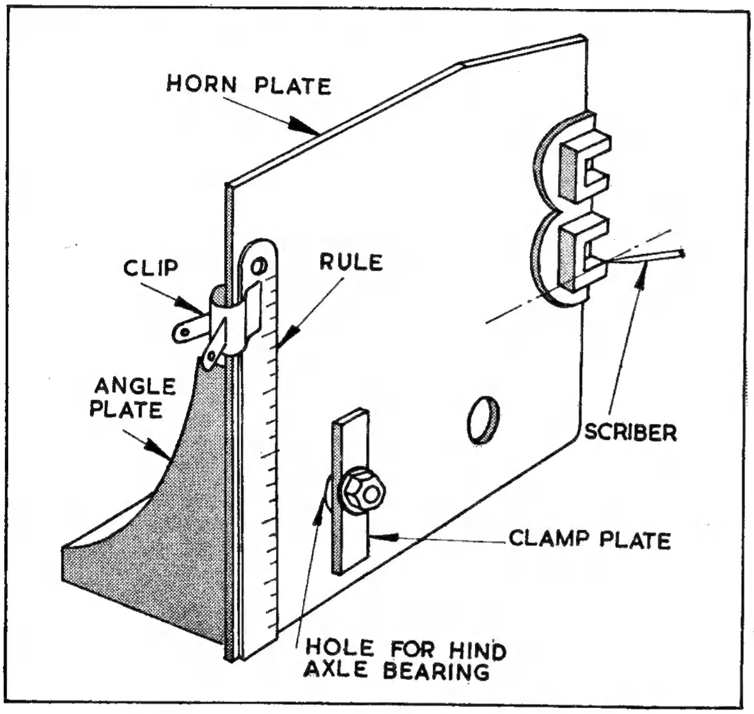
Making use of the special centre for screwcutting the nose

(*To be concluded*)

The Allchin "M.E." Traction Engine to 1½ in. Scale

BY W. J. HUGHES

AFTER machining the bearings for the crankshaft and second shaft, the next logical thing to do, of course, is to fit them to their brackets on the hornplates. To do this it will be necessary to set out, and then to file out or machine, the slots in the brackets, in which the brasses should be a good fit.



Fig, 71. Sketch to show method of holding hornplate and rule

Hand Filing

If you possess a milling machine, you will be able to machine the slots out on this, but the average 3½-in. lathe does not allow sufficient clearance, or travel in the vertical slide, to allow them to be end-milled out. It will, therefore, be necessary to resort to hand-filing.

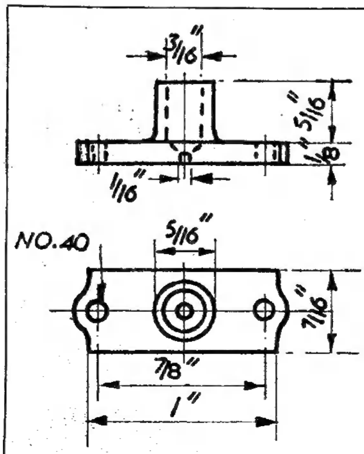
Now for some reason many model engineers shy away as much as possible from filing, and will go to almost any length to avoid it. In fact, to do so some will spend a great deal of time and thought in making a complicated jig or working out some elaborate machining set-up, where with a file the job could be done in half the time.

In some cases this is because they genuinely believe that a surface generated by a machine must of necessity be more accurate than one resulting from hand-work: in others it is because they like making jigs and fixtures. But in many cases it is either because they cannot file accurately, or because they lack confidence in their ability to do so.

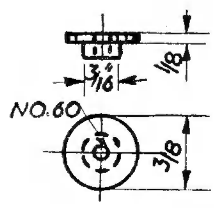
Incidentally, this was the subject of an informal discussion at our local club a week or two ago, and it was generally agreed that in the hobby today, there is frequently too much reliance on machining and jigs, and not enough on the cultivation of the type of hand skill which is really necessary before a first-class model can be built.

Filing is a case in point. Some of the finest models ever built have been made with a minimum of equipment—I remember some years ago a model engineer describing in THE MODEL ENGINEER how he had built a model of an old-time table-engine (which won high acclaim at the "M.E." Exhibition) entirely without the use of machine-tools. All the bits and pieces—cylinder, valve-chest, flywheel, and so on—were shaped and fitted with the file. This shows what *can* be done with care and perseverance.

The tyro is urged, therefore, to cultivate skill with the file and other hand tools on all possible occasions: he will not acquire dexterity by



Left—Fig. 72. Keeps for bearings



Below—Fig. 73. Caps for oil-holes

Continued from page 831, "*M.E.,*" *Vol.* 107, *December* 25, 1952.

shying away from the problem all the time. The only solution is practise, practise, and *more* practise, and he can be assured that there is a great satisfaction—almost a sense of triumph—in being able to rely on one's hands for filing a true surface, or fitting a bearing, or even in grinding a twist-drill.

Marking-out the Brackets

To mark out the brackets for filing, put a large angle-plate on the surface-plate—for which I use a piece of $\frac{1}{2}$-in. *plate*-glass—and clamp one of the hornplates to it, with the top edge of the hornplate vertical instead of horizontal : check this with the square. The hornplate itself should not touch the surface-plate.

Now you should still have the centre-lines of the bearings marked on the hornplates, $1\frac{1}{2}$-in. apart. Set the scriber point of the surface-gauge to that of the crankshaft, and very carefully measure its height from the surface-plate, taking care that the rule is square both ways with the latter ; otherwise, of course, you will get a false reading. (You can use a bull-dog clip to fix the rule to the hornplate, as shown.)

The slots for the bearings are $\frac{5}{8}$ in. wide and $\frac{5}{8}$ in. deep (see drawings in "M.E." dated July 10th, 1952), so, having now ascertained the level of the centre-line, set the scriber point $\frac{5}{16}$ in. above it, and mark a line on both the inside and outside faces of the bearing bracket. Drop the point $\frac{5}{8}$ in., and repeat the operation : then similarly mark out the lines on the second shaft bracket, at $\frac{5}{16}$ in. each side of this shaft's centre-line.

Next, turn the hornplate through 90 deg., setting it so that the top edge is now parallel with the surface-plate. Set the scriber-point to $\frac{5}{8}$ in. from it (the top edge, not the surface-plate !) and scribe lines on both sides of both brackets. Finish off by scribing a line on both, level with the top edge—you will remember that we did not file off the brackets flush when they had been riveted in place.

When one pair of brackets are marked out, the next thing to do will be to set the other hornplate on the angle-plate, and mark out the slots on that.

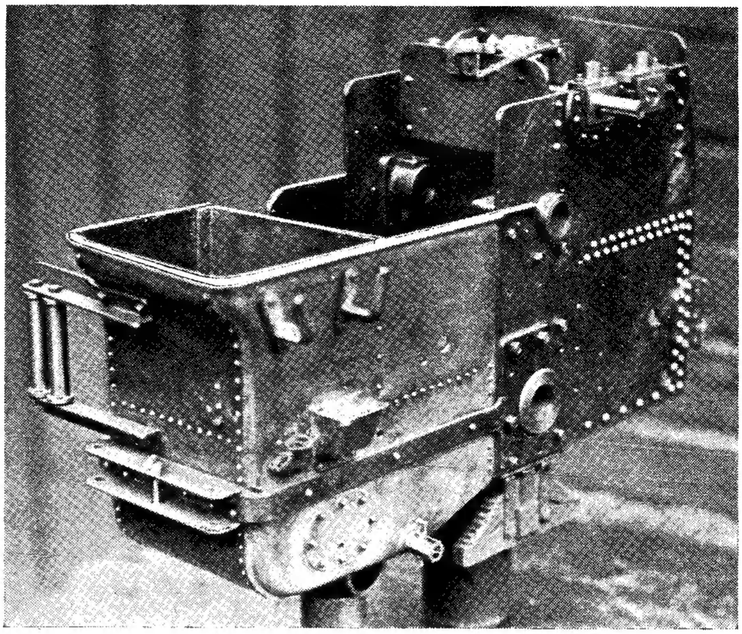
Filing the Slots

In filing the slots, the chief things needed, besides the files and a bit of elbow-grease, are patience and care. It will be advisable to centre-dot the marked-out lines first, as we have done before, which helps when finishing to the line. Use a fairly coarse file at first, and file down *nearly* to each line in turn—but when working to one line, keep your eye as well on the others, particularly if using a square file. It is so easy to take a bit off where you should not ! In fact, on some of my square files I have ground the teeth off one side so as to have a "safe-edge"—an old dodge, but none the worse for that.

The secret of good filing ,of course, is not to rock the file, as has been emphasised many times in The Model Engineer. This means that at the beginning of the stroke, most of the pressure should be on the front end of the file, in the middle of the stroke it is evenly distributed, and at the end of the stroke it is mostly on the back end. Once a tyro gets the hang of it, he will soon wonder whatever he found difficult about it before ! But it *does* need practise !

When you have filed nearly to the lines, use a smoother file, and carry on until the bearings will fit in the slots. Fit one at a time, of course, and as each is fitted, mark it on the inside with small letter or number punches to identify it. (Mine are marked "L.C." and "R.C." for the crankshaft bearings, and "L.2" and "R.2" for those of the second shaft.)

One particular point to note is that the *front* or outside face of the brackets may need easing slightly with a fine file, by the bye. The bearings should so fit in the brackets that there is no slop or shake either forwards or sideways, yet you should be able to slide them in or out without using excessive force.



Photograph No. 21. Trevor Whittaker's Allchin is coming along nicely

The Bearing Keeps

The keeps for the bearings may be fabricated, or may be machined from gunmetal castings.

If the latter are used, a chucking spigot will help. This can be gripped in the three-jaw, with the oil-box outwards, the base and oil-box being turned at one operation, with a slight radius in the bottom corner.

Face the end, centre it, and drill the $\frac{3}{16}$-in. hole, $\frac{5}{16}$ in. deep. Then reverse the work in the chuck, and turn off the chucking spigot, at the same time facing the base off to $\frac{1}{8}$ in. thick. Light cuts will be necessary here, to avoid distorting the base flanges. Centre, and drill the $\frac{1}{16}$-in. hole to meet the $\frac{3}{16}$ in. one. Finish the base to shape by filing, and set out and drill the two No. 40 holes.

If the castings are without chucking spigots, grip the oil-box in the three-jaw, and face the underside of the base. Centre, and drill a $\frac{3}{16}$-in. hole right through. Remove the casting from the chuck.

Now turn a $\frac{3}{16}$ in. dia. spigot about $\frac{1}{4}$ in. long on a stub of brass rod, and sweat the casting on the spigot. Grip the rod in the chuck to turn

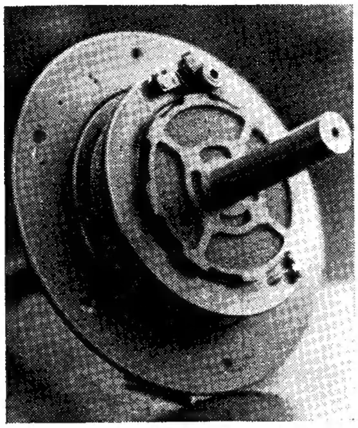
the oil-box and upper surface of the base, and then unsweat the two. This, of course, leaves a $\frac{3}{16}$-in. hole right through the oil-box, but it merely gives a little more oil capacity to it. In fact, it could be done with the spigoted castings.

One point not shown on the drawing of the bearings themselves, by the way, was that a $\frac{1}{16}$-in. oil-hole should be drilled centrally through the top surface. As with the bearings for hind axle and third shaft, a small groove may be scraped or filed across the inside of the bearing-hole, coinciding with the oil-hole, but it should not come right through to the outside edges.

The lids or caps for the oil-boxes are a simple turning job, from brass rod, and do not need detailed instructions. Note, however, that the flange is slightly rounded on the edge, and that the spigot should be a good, but not too tight, fit in the $\frac{3}{16}$-in. hole of the box. And, since the lids might easily be lost, it may be a good idea to make two or three "spares" while you are about it!

It is another simple job to fit the keeps. Place one of the bearings in its slot, and clamp one of the keeps in position above it, fitting into the upper groove of the bearing. See that it is centrally placed, and "spot" the two holes through into the upper surface of the bracket, using a No. 40 drill.

Remove the keep and the bearing, and drill the two holes in the bracket



Photograph No. 22. Left-hand driving assembly of the Allchin. Note pawl for driving winding-drum

with a No. 47 size drill to a depth of $\frac{5}{16}$ in. or $\frac{3}{8}$ in. Tap the holes 3/32 in. or 7 B.A., and insert the holding-down studs. The keeps will later be fitted with nuts and lock-nuts—steel, please, not brass.

Photographs

Judging by the photographs which keep reaching me (though many are not suitable for reproduction), there are some excellent models of the Allchin being built.

One of these is the handiwork of Mr. Trevor Whittaker, of Cardiff, who recently sent me several photos. two of which are reproduced herewith. Mr. Whittaker is well ahead of this "serial," as the illustrations show.

The first is, of course, the tender and hornplate assembly, and the second shaft is in position, with the gear-change mechanism and gear-centres in place. The second photo shows the hind-axle, with the main spur-ring, the winding-drum (complete with wire-rope), and the driving centre; the latter has still to be drilled with the four holes for the driving-pins.

(To be continued)

FOR THE BOOKSHELF

Newnes Engineers' Reference Book (Fifth Edition). Edited by F. J. Camm. (London: George Newnes Ltd.) Price 50s. 1,909 pages, $7\frac{1}{4}$ in. $\times$ $4\frac{3}{4}$ in.

The latest edition of this popular reference book has been enlarged and brought up to date. It now contains, in addition to statistical information and tables on engineering standards, formulae, calculations, etc., a great deal of descriptive matter on all departments of engineering practice, including thermodynamics, hydraulics, belt drives, bearings, couplings, springs, keys, machine shop practice in all its branches, and, in fact, all that the practical engineer, draughtsman or designer needs to keep handy for ready reference.

Fractional Horse Power Motors. By Stuart F. Philpott. (London: Chapman & Hall Ltd.) Price 30s. 366 pages, $8\frac{3}{4}$ in. $\times$ $5\frac{1}{2}$ in.

The rapidly increasing application of small electric motors, both in industrial and domestic equipment, have resulted in far-reaching improvements in their design and methods of production, and this comprehensive and up-to-date book on the subject is therefore very opportune at the present time. In the introduction, the principles of electric motors, and the various types in use, are described, the following chapters then dealing in detail with the electrical and mechanical characteristics of each type in turn. These include direct current, universal, polyphase, single-phase and shaded-pole motors, after which further details are given of three of the most popular types of f.h.p. motors, namely, split-phase, capacitor and repulsion-induction motors. A chapter is devoted to synchronous motors, as used in clocks and repeater mechanism. Construction choice of types, applications, methods of testing, and suppression of radio interference, are dealt with in the concluding chapters. The entire treatment is practical rather than theoretical, and the book is illustrated with numerous line drawings diagrams and photographs.

Two-stroke Motor Cycles (11th edition) by *The Motor Cycle* staff. (London: Iliffe & Sons Ltd.) Price 5s., postage 4d. Size $7\frac{1}{2}$ in. $\times$ 5 in., 150 pages, 82 illustrations.

The latest edition of this popular book has been brought fully up to date, to keep pace with the many developments in the design of the engines and other parts of these machines. It gives practical advice on all constructional features of the engine, including carburation, ignition, lighting, lubrication, etc., also the gearbox and cycle parts. Advice on buying either new or secondhand machines, driving, care and maintenance, tracing troubles and tuning, are also included.

British Cars (1952), by Peter Chambers. (Birmingham: P.C. Publications.) Price 6s. 56 pages, $9\frac{3}{4}$ in. = $7\frac{1}{4}$ in.

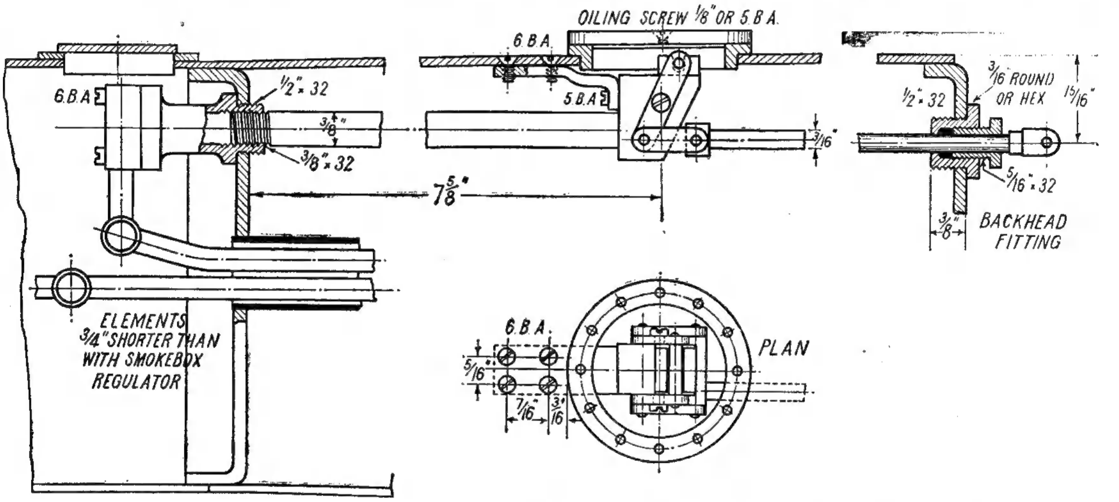
Specifications of 36 makes of cars are given in this book, with photographs and general description of the various models of each make, on every page. Great Britain offers the world a wider variety of cars than any other country, as can be seen from these well-displayed illustrations. Citroen and Renault cars, although made of French components and to French designs, are included in the list, as they are assembled in this country for the British market. The end pages of the book contains tabulated data on all the cars dealt with, including prices ruling in August, 1952.

L.B.S.C.'s "Britannia" in 3½ in. Gauge

● ALTERNATIVE REGULATOR OF THE SLIDE-VALVE TYPE

EXACTLY as I surmised, that poppet-valve gadget has scared several builders of the small *Britannia*, not so much for the actual making of the blessed thing, but the apprehension of being unable to keep the valves steamtight in the hot smokebox. This is not altogether unfounded, because smokebox regulators of certain kinds give trouble through leakage in full-size practice. Anyway, I always try to do my best for all and sundry ; so here is an alternative regulator which is quite easy to make, can be located in the dome, and if occasionally oiled through the screwhole specified, should be easy to operate and is not liable to leak. It can be operated by exactly the same "standard" regulator handle as the poppet-valve type. I am fitting this type to my own boiler. Incidentally, it is rather a significant fact that all the other standard British Railways locomotives have dome regulators.

At the smokebox end there is a distance-piece, similar to the one previously specified, but a little longer, to which the superheater flange is attached. The steam-pipe is straight, and terminates in a block which forms the body of the regulator. The top of this is truly faced, and carries a plain flat slide-valve working over a circular port. The valve is moved back and forth by a double-armed lever at each side, the upper ends of the levers being rigidly connected by a bar which fits in a slot in the upper part of the valve. The lower ends of the levers are coupled by short links to a rectangular crossbar, into which is screwed a pull-and-push rod. The latter projects through a gland of the usual pattern on the backhead, where it is furnished with a fork, for connecting to a drop arm on a spindle carried in two brackets on the backhead ; the outer end of the spindle carries the "standard" regulator handle, located in the same position as on the full-sized engines. The handle and connections are not shown in the accompanying drawings, but will be described and illustrated along with the rest of the backhead fittings. It will be noticed that the gland on the backhead is not in the customary central position, but is offset to the left. This is owing to the centre girder crown stay being in the "line of fire," in a manner of speaking ; the regulator rod has to run alongside it, as shown in the end view. It is no detriment, as the regulator handle is not directly connected to it ; and as the rod is rigidly screwed into the crossbar operating the actual regulator valve, the pull is even at both ends of same. That's that ; now we'll proceed to make it and fit it, together, starting from the front end.



Details of the alternative slide-valve regulator

Distance Piece

This may be cast, turned from solid, or built up. If cast, chuck in four-jaw by the square flange, and set to run truly. Face, centre, and drill right through with $\frac{5}{16}$ in. drill ; tap the end $\frac{3}{8}$ in. × 32 for about $\frac{3}{8}$ in. down. Turn down $\frac{5}{16}$ in. of the outside, to $\frac{1}{2}$ in. diameter, and screw $\frac{1}{2}$ in. × 32, truing up the outside of the round flange at the same setting ; the exact diameter doesn't matter. Either reverse in chuck, or hold the piece in a tapped bush in the three-jaw, and face the square flange.

If turned from solid, chuck a piece of $\frac{7}{8}$ in. square brass rod in four-jaw, setting to run truly. Face, centre, drill down about $1\frac{3}{8}$ in. depth with $\frac{5}{16}$ in. drill, and tap as above. Turn down $\frac{5}{16}$ in. of the outside, to $\frac{1}{2}$ in. diameter, screw $\frac{1}{2}$ in. × 32, and then turn down a further $\frac{3}{4}$ in. length to $\frac{3}{4}$ in. diameter. Reduce the middle part to $\frac{1}{2}$ in. diameter, leaving a $\frac{3}{4}$ in. flange at the end as shown, and part off at $\frac{15}{16}$ in. full from the shoulder. Reverse in chuck, and skim off the face of the square flange. Round off the corners, and you're through.

To build up, a piece of $\frac{1}{2}$-in. round rod a full $1\frac{1}{4}$ in. long is needed. At $\frac{5}{16}$ in. from one end, fit a circular

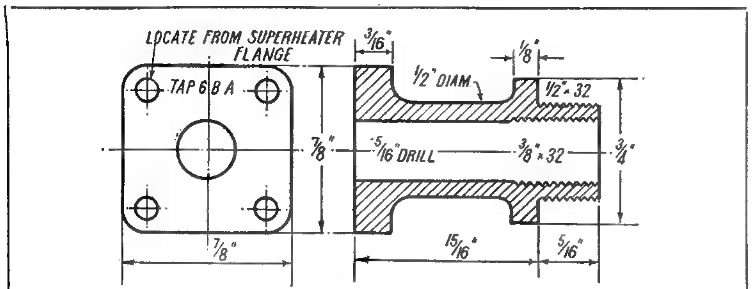
washer ¾ in. diameter and ⅛ in. thick. On the other end, fit a ⅞ in square flange 3/16 in. thick, which can be cut from brass plate, or anything else available. Silver-solder both, and machine up as given for the casting, mentioned above.

Regulator Body and Valve

The regulator body may either be a casting, with the supporting bracket cast integral with it, or it may be a 13/16 in. length of ½ in. × ⅞ in. brass bar, with the supporting bracket screwed on, as shown in the general arrangement of the whole doings. The machining and fitting are practically the same; if the casting is rough, just smooth it with a file. If a piece of bar is used, saw and file to shape shown. At 5/16 in. from the bottom of the front end, drill a 5/16-in. hole 5/16 in. deep, and tap it ⅜ in. × 32 for the steam pipe. On top, at 7/32 in. from the sloping end, drill a ¼-in. hole slanting down into the tapped hole. At 9/32 in. from the top, and on the vertical centre line of each side, drill a No. 48 hole and tap it 3/32 in. or 7 B.A. for the pivot screws of the side levers. It doesn't matter if you pierce the steam-way, as the screws will plug the holes. Face the top truly, as described for slide-valves, port faces, etc., by rubbing first on a smooth file, and then on a piece of fine emery-cloth or similar abrasive laid on a perfectly true surface. If the body is made from bar, bend up a bracket from ½ in. × ⅛ in. flat brass rod, to shape shown, and attach it to the body by two ⅛-in. or 5-B.A. brass screws.

The valve is merely a block of gunmetal or bronze measuring 7/16 in. × a full 15/32 in., and 7/32 in. thick, with a ⅛ in. slot cut across the widest measurement. Although the drawing shows this slot round-bottomed, it doesn't matter a bean if it is square; and it can be end-milled in the lathe by clamping it on its side, at centre height, under the lathe tool holder, and traversing it across a ⅛-in. end-mill, or preferably a home-made slot drill, held in the three-jaw. Face truly as above.

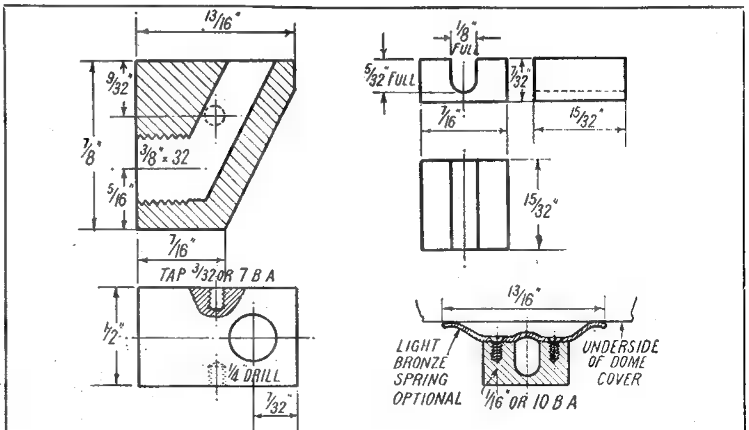
When this valve is erected, the steam pressure will keep it tightly on the working portface of the regulator body, same as an ordinary slide-valve is kept to the portface of a slide-valve cylinder, However, if the engine is turned upside down for any purpose, such as cleaning the underside of the motion, or making adjustment to springs, or other parts, the valve will drop from the portface, and scale or grit may get between, causing scoring and leakage. This can easily be prevented by fitting a flat spring to the top of the valve. The spring is merely a bit of springy bronze strip, ½ in. wide; the hard bronze strip used for brush springs on dynamos and motors, is just the identical for the job. This is bent to the shape shown, and attached to the top of the valve by a couple of 1/16-in. or 10-B.A. countersunk brass screws, being finally attached before putting the dome cover on, after the regulator has been erected. The pressure should be just sufficient to keep the valve on its face, and no more; the ends should be bent over, so that they slide easily on the under surface of the dome cover.



The distance-piece

Operating Gear

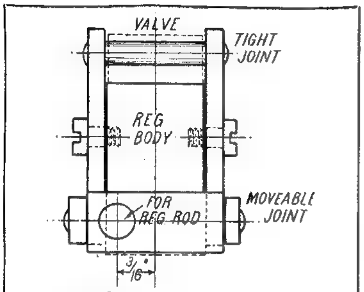
All the levers or links are made from ¼ in. × 3/32 in. strip metal; nickel-bronze (German silver) is about the best, but brass will do at a pinch. All dimensions are given in the illustrations. The hole in one end of each double-armed lever is drilled No. 48 and tapped 3/32 in. or 7 B.A., and countersunk slightly. In it is screwed a ⅛-in. stub of 3/32-in. bronze wire, as shown, the inner side being riveted over into the countersink, and filed flush, to avoid any chance of its coming adrift when the engine is at work. The connecting bar, which works in the slot in the valve should preferably be made from drawn phosphor-bronze rod, but nickel-bronze will do. Chuck a piece ⅛ in. diameter in the three-jaw, and turn down ⅛ in. length to a tight fit in the No. 41 hole in the lever. Part off a full ⅝ in. from the shoulder, and turn down the opposite end in a similar manner, leaving the ⅛-in. part a full ½ in. long, a weeny bit longer than the width of the block. Then assemble as shown, driving one of the double-armed levers, pins outward, on to the ends of the bar, and riveting over. The two levers must be parallel, and the completed yoke should fit easily, but without slackness, over the regulator body.



Regulator body and valve

The rectangular connecting bar, by which the valve is operated, is made from bronze or gunmetal

rod of $\frac{5}{16}$ in. × $\frac{1}{4}$ in. section, or $\frac{5}{16}$ in. square would do. Chuck truly in four-jaw, and turn a $\frac{1}{8}$-in. pip on the end, an easy—but not sloppy—fit in the hole in the end of the side link. Part off at a full $\frac{13}{16}$ in. from the shoulder ; reverse in chuck, and ditto repeato the pip-turning, leaving $\frac{11}{16}$ in. full between the shoulders. On the centre line of one of the wider sides, at



Back view of assembly

$\frac{3}{16}$ in. from the middle of the bar, drill a 5/32-in. hole and tap it $\frac{3}{16}$ in. × 40.

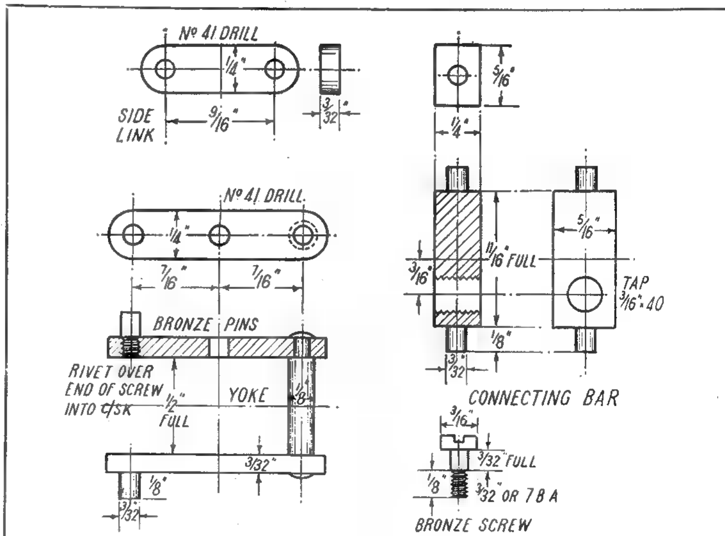
Make two pivot screws, as shown, from $\frac{3}{16}$-in. round bronze. Chuck the rod in three-jaw, and turn down a bare $\frac{1}{8}$ in. to 3/32 in. diameter, a nice fit in the holes in the side links. Slip a link over the turned part, and run a 3/32-in. or 7-B.A. die on until it just touches the link ; this will ensure that the lever will still be free when the screw is home to the end of the thread.

How to Assemble and Erect

Put a side link on the pip at each end of the rectangular connecting bar, and lightly rivet over the ends of the pips, so that the links are free to move, but cannot come off. Note—before riveting over the second pip, put the yoke in place, at the opposite end, the pips on the outer ends of the double-armed levers going through the holes in the links. Then finish riveting over all the pips. Be careful not to overdo it ; the links must be perfectly free to swing on the double-armed levers, and the ends of the rectangular bar. See that both valve and portface are perfectly clean ; put the valve on the face, and drop the yoke over it, so that the round bar enters the groove in the valve. Put the bronze screws through the holes in the middle of the double-armed levers, and screw tightly into the holes in the regulator body. If the holes have been drilled right into the steam way, smear a taste of plumbers' jointing over the screw threads before inserting.

The back view of the assembly should give a good idea of how the pieces go together ; incidentally, it shows that the tapped hole for the regulator rod should be toward the left side of the connecting bar, when viewed from the back.

At 5/32 in. on each side of the top centre-line of the boiler, and $\frac{3}{16}$ in. ahead of the dome bush, drill two No. 34 holes, and at $\frac{7}{16}$ in. ahead of them, drill two more ; countersink all four. Now insert the regulator assembly through the dome bush ; it will go in all right if you tip it up, but don't let go of it, or you're sunk ! Hold the whole bag of tricks in the centre of the hole, as shown in the plan view, and scribe circles on the bracket, through the drilled holes in the boiler shell. Take out the regulator again, make centre pops plumb in the middle of each wee circle, drill No. 44, tap 6 B.A., and put the whole doings back again, securing with four 6-B.A. brass countersunk screws as shown. A smear of plumbers' jointing on the countersinks, should render them



Regulator operating gear

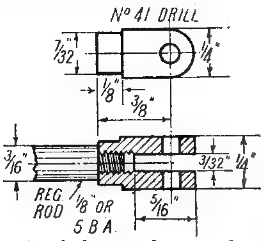
steamtight ; but in the event of leakage when the boiler is in steam, the heads could be soldered over. The regulator should be quite firm when the screws are tightened.

The main steam pipe is a $7\frac{5}{8}$ in. length of $\frac{3}{8}$ in. × 20 gauge copper tube (thicker if you like, but not thinner, or it won't take a screw thread) with $\frac{3}{16}$ in. of $\frac{1}{2}$ in. × 32 thread on one end, and $\frac{3}{8}$ in. of ditto on the other. Anoint both ends with plumbers' jointing, and poke the shorter-screwed end through the $\frac{1}{2}$-in. tapped hole in the smokebox tubeplate, screwing same into the hole in the front of the regulator block. A round file pushed into the end of the tube, is an excellent persuader, and releases readily when turned the other way. Then screw the distance piece on the smokebox end—don't forget the jointing—and carry on until the outer threads engage with the tapped hole in the tubeplate, and the flange seats home against it, as shown in the assembly drawing.

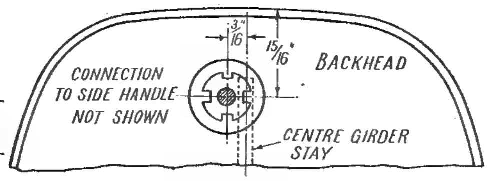
Regulator Rod and Backhead Gland

The rod is made from $\frac{3}{16}$-in. nickel or phosphor-bronze (rustless steel will do, but be sure it *is* rustless !) a piece approximately $12\frac{3}{8}$ in. long being required. One end of this is screwed $\frac{3}{16}$ in. × 40 for $\frac{1}{4}$ in. length ; the other end is turned down to $\frac{1}{8}$ in. diameter for 5/32 in. length, and screwed $\frac{1}{8}$ in. or 5 B.A. A fork is made from $\frac{1}{4}$-in. square steel to fit on this end ; I have described how to make these so many times, that repetition is needless, the illustration showing all dimensions.

The gland fitting is made from $\frac{3}{4}$-in. round or hexagon brass rod, or it may be a casting. Chuck in three-jaw, face, centre, and drill down for $\frac{5}{8}$ in. depth with No. 12 drill. Turn down $\frac{3}{8}$ in. of the outside to $\frac{1}{2}$ in. diameter, and screw $\frac{1}{2}$ in. × 32. Part off at $\frac{1}{8}$ in. from the shoulder. Reverse, and rechuck in a tapped bush held in three-jaw ; open out the hole to 9/32 in. diameter for $\frac{3}{8}$ in. depth, and tap $\frac{5}{16}$ in. ×



Fork for regulator-rod



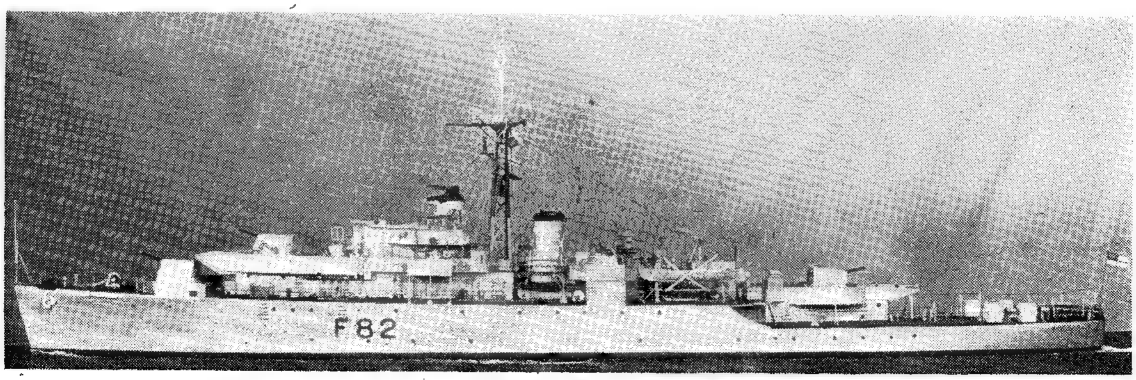
Position of regulator gland

32, skimming the face truly at same setting, and chamfering slightly if hexagon stock has been used. Make a gland to suit, from ½-in. round or hexagon bronze rod, by same process as described for piston-rod glands. At 15/16 in. from the top of wrapper, and at 3/16 in. to the left of the centre-line of the backhead, as shown in the illustration, drill a 29/32-in. hole, and tap it ½ in. × 32. Screw the gland fitting in tightly, with a smear of plumbers' jointing on the threads. Poke the screwed end of the regulator rod through, and push forward until it reaches the hole in the bar at the back of the regulator, then screw right home. "Corluvaduck, it's going to be some job to hit the bull's-eye" says two or three worthy brothers. Not at all!—everything is easy when you know how. Bend a bit of thin wire into a loop like a hairpin, and drop it down behind the regulator, so that when you push the rod home, it will pass through the loop. It will then be quite an easy matter to guide the rod to the hole in the bar, by manipulating the wire loop; and when the rod has been screwed home, let go one side of the hairpin loop and pull the other—out she comes, and Bob's your uncle once more. Finally, pack the gland with a few strands of graphited yarn, and put a spot or two of cylinder oil on the valve and port faces. The regulator should work perfectly when the fork end of the rod is pulled or pushed, the valve sliding from one end of the portface to the other. No stops are needed on the valve, as these will be arranged on the regulator handle on the driver's side of the cab. The flat spring can be attached to the top of the valve by the two small screws shown, and the ends bent, so that when the dome cover is in place, it just touches them, and prevents the valve from lifting. Fit an oiling screw in the cover as shown, but don't screw the cover down permanently yet, as we have to check the extremes of movement after the regulator handle has been made and fitted.

A Model of the Duke of Edinburgh's Ship

OUR readers will be interested in the photograph of the model of H.M.S. *Magpie*, presented to the Duke of Edinburgh at the "M.E." Exhibition, which is reproduced in this page. The idea of the model was first suggested to Percival Marshall & Co. Ltd., during the early summer last year by Mr. A. D. Trollope, of the Imperial War Museum. The firm gladly sponsored the idea and, as time was limited, decided that the work should be divided amongst a number of modellers to ensure its completion before the exhibition; and, further, it was felt that the model should be the product of a representative team of ship modellers, rather than of one man. Mr. Trollope, therefore, got together a team of well-known modellers, each expert in his own line, and the work was shared out amongst them. The Admiralty supplied the necessary information, and in this connection, the contacts already made by Mr. Glossop were extremely helpful. The work went forward very satisfactorily, and the model was completed in time for the exhibition. The ship is shown under easy steam in a fairly smooth sea. The model is to the scale of ⅛ in. = 1 ft. After the presentation, each member of the team was presented to the Duke, who obviously was interested to meet them. The members of the team were Mr. A. D. Trollope' Mr. J. B. Glossop and Mr. M. Morwood, all of the Imperial War Museum; Mr. A. S. Abblett, of Ruislip; Mr. R. A. Chapman, of Buckhurst Hill; Mr. G. H. Draper, of Ilford; Mr. A. E. Field, of Walsall; Mr. W. H. Honey, of Tulse Hill, S.W.2; Mr. F. A. A. Pariser, of Castle Bromwich, and Mr. N. M. Peters, of Wallington. It may be mentioned that most of the team have won cups or medals at previous "M.E." Exhibitions.

The photograph was taken by Mr. William Rowell, who is specialising in the photography of models. We think he has made a very good job of this one.



STUB DRILLS

By "Duplex"

WHEN drilling a large casting mounted on the table or base of the drilling machine, it will often happen that there is insufficient head-room for a drill of the standard length to be used ; that is to say, where the drill is of large diameter and the drilling machine of small capacity.

Although, in these circumstances, a broken drill may serve, after it has been reground and the point thinned, there is little likelihood of a supply of short drills in the larger sizes being forthcoming from this source.

However, for this purpose, the range of stub drills can often be used with advantage in a drilling machine of limited capacity.

These stub drills are generally only a little more than half the overall length of the corresponding jobber's length drills, and the fluted part is made in proportion. For example, the $\frac{1}{2}$ in. dia. jobber's drill has a total length of 6 in., with flutes $4\frac{1}{2}$ in. long ; whereas in the corresponding stub drill these lengths are 4 in. and $2\frac{1}{4}$ in. respectively. Moreover, for small constructional work a drilling depth of $2\frac{1}{4}$ in. will usually suffice for $\frac{1}{2}$ in. dia. holes.

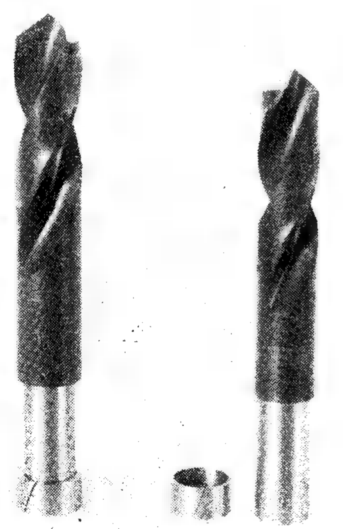


Fig. 2. A $\frac{5}{8}$ in. dia. and a $\frac{9}{16}$ in. dia. stub drill with machined shanks and removable collars for jig grinding

Another point in favour of the stub drill is that, owing to the saving of material, a high-speed steel stub drill costs less than a drill of full length, and this should be taken into account when the price of carbon-steel drills is considered.

A series of high-speed steel stub drills, ranging in diameter from $\frac{1}{8}$ in. to $\frac{5}{8}$ in., is shown in Fig. 1. Drills of the high-speed steel variety are recommended, as they retain their sharpness longer and are not so easily damaged if the cutting edges become heated during grinding.

A further advantage of the short drill is that it is usually more convenient to use in the tailstock drill chuck when drilling work mounted in the mandrel chuck or on the lathe faceplate.

Here, the greater stiffness of the short drill enables the point to make an accurate start in the work, and the axial alignment of the drilled hole is more readily maintained.

Where a hole is drilled for the purpose of removing surplus metal, so as to admit a boring tool when the work has been set up in the lathe, it will save time if, at the outset, the bore is drilled nearly to the finished size. But the holding capacity of the drilling machine chuck may be limited to $\frac{1}{2}$ in., or even $\frac{3}{8}$ in. It follows, therefore, that, to enable a stub drill of, say, $\frac{5}{8}$ in. dia. to be mounted in the chuck, the diameter of the shank must be correspondingly reduced.

Mounting Large Drills

The two larger drills illustrated, $\frac{7}{16}$ in. and $\frac{5}{8}$ in. in diameter, have had their shanks reduced to $\frac{1}{2}$ in. dia. so that they can be held in the $\frac{1}{2}$ in. capacity chuck of the workshop drilling machine. To adapt a drill in this way, the holding length of the chuck jaws on a $\frac{1}{2}$ in. dia. rod is first measured ; this was found to be $1\frac{3}{16}$ in. and represents the length of the drill shank machined to a reduced diameter.

As it is essential that the drill should be accurately centred for the machining operation on the shank, the drill is mounted, reversed, in the four-jaw chuck and centred with the aid of the test indicator. The parallel portion of the shank of the larger drill gripped by the jaws of the four-jaw chuck is 1 in.

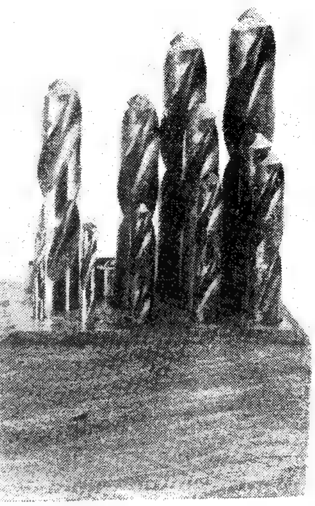


Fig. 1. A set of stub drills ranging in diameter from $\frac{1}{8}$ in. to $\frac{5}{8}$ in.

in length, and this is sufficient to provide an accurate mounting.

The machining was carried out with a high-speed steel knife tool with the lathe running on the slow, direct speed.

It is, of course, important that the shank should be turned exactly parallel, and a good finish will be obtained if the automatic traverse is engaged and a good supply of cutting oil is maintained on the work. If the high-speed steel tool does not cut freely, it may be found necessary with some drills to use a tungsten carbide tipped tool for the machining.

Grinding the Machined Drills

Those who grind free-hand will have nothing to worry about, but the reduced diameter at the end of the shank may give rise to difficulty in aligning the drill in some types of drill grinding jigs. Therefore, to enable the full length of the shank to lie in contact with both the V-guides of the jig, a collar is machined to the nominal diameter of the drill and is afterwards bored to fit closely on to the end of the shank.

Two of these collars are illustrated in Fig. 2, and their dimensions are given in Fig. 3. To ensure an accurate fit, and, at the same time, to enable the collar to be readily replaced, the collar is bored a thousandth of an inch undersize and then slit diagonally with a fine hacksaw.

Preparing the Drill for Use

Although there should be no

(*Continued on page* 108)

Notes on LATHE MANDRELS

By "Base Circle"

SOONER or later, every lathe owner finds himself confronted with a job which necessitates the use of a mandrel—the outside of a bush or wheel must be trued up to the bore, or a finished part must be reduced in diameter. When this happens, more often than not, a piece of bar is hurriedly chucked and turned to fit the bore of the part. When the job is finished, the mandrel (!!) is thrown away. If the job is a "between-centre" one, a piece of bar will be centred any old how, turned to suit and again discarded immediately the job is done. Well, of course, that is one way to get the work done, and at first sight it appears to be the quickest way; but, I think, in the long run it is much better to provide a set of mandrels to cover the likely sizes of work to be handled. This way, the mandrels will be more likely to be properly made and properly finished, and the results, as regards concentricity between bore and outside diameter on the jobs being done, will be very much better than if makeshift mandrels are used. When a set of mandrels is available, it is surprising how soon one acquires the habit of suiting the dimensions of the job to the size of mandrels in the set.

It may be thought that there is nothing to a mandrel—any old piece of stuff will do—but this is far from the truth. If reasonably accurate results are aimed at, and surely we all want to do as good a job as we can, then there are quite a number of important points to watch, both in the design and making of a mandrel.

Well, to get down to brass tacks, Fig. 1 shows a plain mandrel. Such mandrels are often called parallel mandrels, though in point of fact they are actually slightly tapered. First, and most important of all, proper centres must be provided. Details are given in the enlarged view. The centres should be made with a standard centre-drill of suitable size. The standard angle for centres is 60 deg. The clearance for the point of the centre is essential, as there must be no danger of the mandrel running *on* the point of the centre. The recessed end shown is also absolutely necessary. It protects the mandrel from the danger of damage to the centre when being driven into the work, and also from accidental damage, should it be dropped. The slightest damage to the centres will obviously throw the mandrel off truth. On production work, the centres of mandrels are most carefully ground, and very often, lapped. Some people like to cut shallow longitudinal grooves in the centres, to allow for possible specks of dirt on the lathe centre, but I don't think we need go as far as that. It will be seen that the body of the mandrel is slightly larger than the projecting ends. This is to avoid the possibility of the lathe driver being screwed on to the finished and accurate part of the mandrel and damaging it.

The body is tapered—about 0.003 in. to 0.004 in. per ft. will be about right. The large end should be slightly above the nominal size and the small end slightly below. The business part of the mandrel should be as smoothly finished as possible and must, of course, be

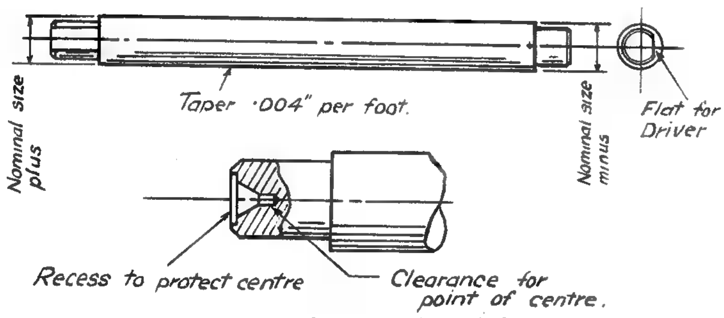
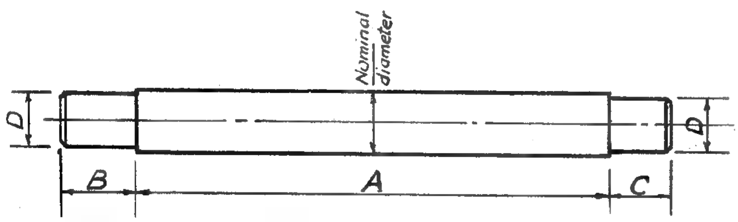


Fig. 1. Plain tapered mandrel



Nominal size	A	B	C	D
1/4	4 1/2	1/2	5/16	7/32
3/8	4 3/4	5/8	7/16	11/32
1/2	5 1/4	3/4	9/16	7/16
5/8	5 3/4	7/8	11/16	9/16
3/4	6 1/4	1	3/4	13/16
7/8	6 3/4	1 1/8	7/8	3/4
1	7 1/4	1 1/4	1	7/8

Fig. 2. Suggested dimensions for mandrels

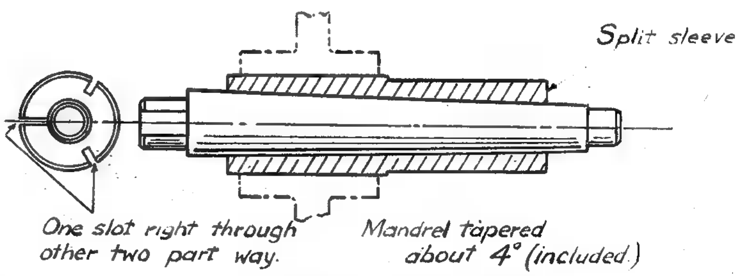


Fig. 3. Expanding sleeve mandrel

true to the centres. To make a really first-class job, the whole tool should be hardened and ground, but I fear that is beyond the resources of most of us. If silver-steel is used, quite a good life can be expected, even though the mandrel is unhardened, provided it is used with reasonable care. It will be seen that the projecting ends are not of the same length. This will be found to be a useful feature, as the longer end indicates the larger diameter. This will save a lot of fumbling about trying to insert the mandrel into the work-piece large end first.

Fig. 2 gives suggested proportions for a set of mandrels covering from ¼ in. to 1 in., rising by eighths of an inch. Larger or smaller sizes can be added, depending on the kind of work being dealt with.

In Fig. 3 we see another type of mandrel. This consists of a split sleeve with a tapered bore which is mounted on a tapered mandrel. This is used by putting the sleeve in the job and driving home the mandrel, thus expanding the sleeve to grip in the work. The amount of expansion is obviously very limited, and the sleeve diameter must only be very slightly under the bore diameter of the work. Mandrels of this kind are more suitable for larger work, and will allow for *slight* variations in the bores. As shown, two diameters may be turned on one sleeve and, of course, a set of sleeves may be made for use with the same tapered mandrel. Cast-iron is a very suitable material for the sleeves, while the mandrel can again be in silver-steel. The same care as regards centres and finish will be required, as in the case of the plain type already dealt with.

Fig. 4 shows another variation of this type of mandrel. In this case the sleeve is expanded in the work by tightening up the nut, which drives it up the taper to grip firmly in the job. This design is very suitable for mounting—not between centres—but on the headstock alone, being carried on a taper shank to suit the spindle. This is shown in Fig. 5. If the taper is Number 2 Morse or larger, quite large work can be dealt with in this fashion, but if the taper is only Number 1 Morse, such mandrels should be restricted to fairly light work. In this connection, perhaps a word of warning to the beginner may not be out of place. Never attempt to carry a mandrel in an ordinary self-centring chuck. Such chucks can never be relied on to hold anything really true. A good one may come within

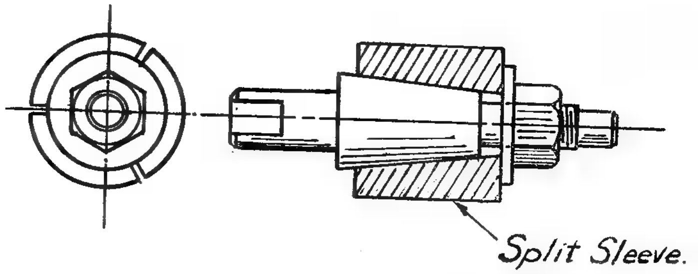


Fig. 4. Screw-operated expanding mandrel

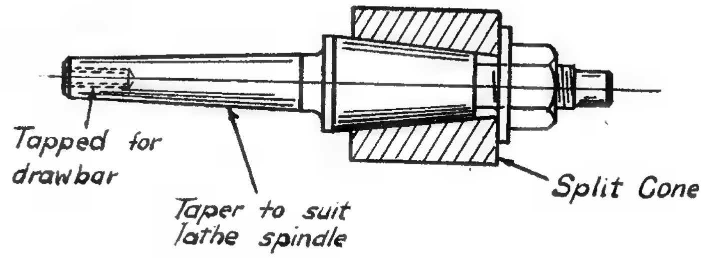


Fig. 5. Expanding mandrel mounted on headstock spindle

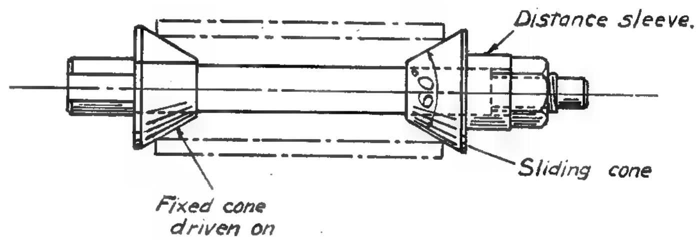


Fig. 6. Cone mandrel

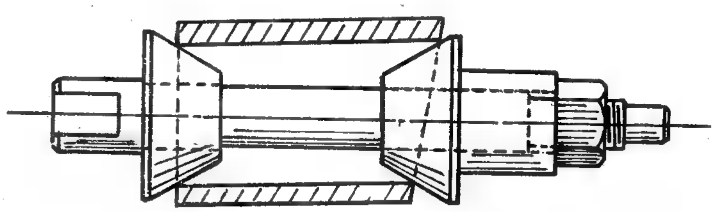


Fig. 7. Showing the effect of using a cone mandrel where the ends of the work are not parallel and square to the axis

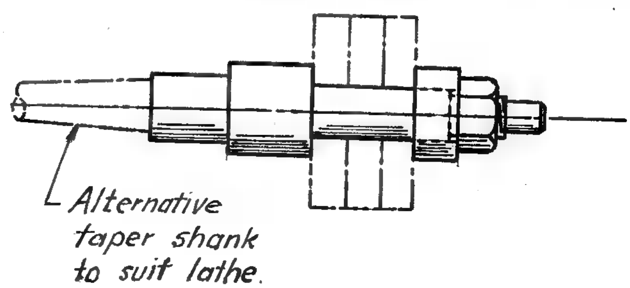


Fig. 8. Special parallel mandrel

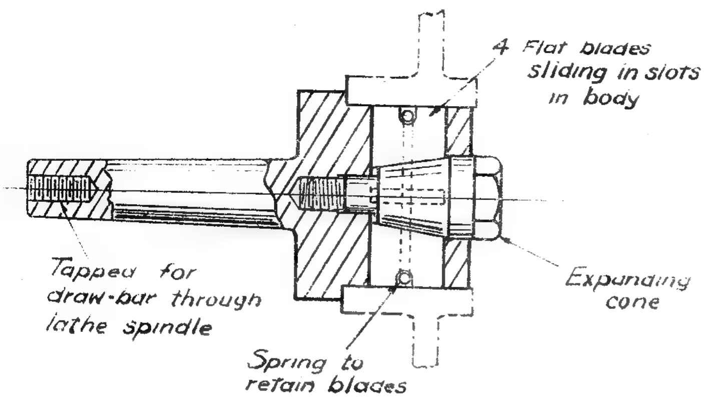


Fig. 9. Special expanding mandrel

0.003 in. of truth, but it is better not to depend on it. If a collet chuck is available, which is not perhaps very likely, the case is different, but even then it is better to mount the mandrel directly in the spindle taper.

Fig. 6 shows a mandrel with tapered cones—one fixed and one sliding, which is very useful for mounting sleeves or tubes for turning. To get reasonable accuracy between the bore and the outside of the job, it is necessary to see that the end faces of the job are parallel and true to the axis before mounting on the mandrel. The effect of neglecting this precaution is illustrated in a very badly exaggerated fashion in Fig. 7. When making a mandrel of this kind it is as well to make it rather long. Shorter pieces can still be accommodated by using additional packing sleeves and, by the way, the ends of these sleeves must also be parallel and true to the bore.

There are many other types of mandrels, but they are usually rather elaborate, and, therefore, perhaps only of academic interest to the homeworker. On production work, it is quite easy to justify a complicated and expensive mandrel which will only be suitable for one job, but obviously this is seldom the case in the amateur workshop. Nevertheless, it will sometimes be necessary to use a mandrel of the style shown in Fig. 8. This, as shown, would be suitable for turning up a set of discs or wheels to the same size.

The design shown in Fig. 9 is included as an example of the specialised and expensive type which could only be used profitably on quantity work. It should be remembered, too, that the diaphragm chuck which the writer recently described can also be used as a mandrel—and a very accurate type of mandrel it will be found to be.

A point which was omitted when dealing with stump mandrels—that is, the type mounted on the headstock—is that, where the taper of the spindle is too small to carry a mandrel of the desired size, it is always possible to mount the mandrel directly on the nose of the lathe spindle, using an adapter screwed to suit the spindle in the same way that the diaphragm chuck was shown mounted. This method involves rather a lot of work, and would only be worthwhile in very exceptional circumstances.

Well, this may appear to be rather a long-winded story about such a simple subject as a mandrel, but I am sure that more attention to the making of the essential equipment required for the lathe would save the worker a lot of time and many disappointments. Too many think that once they have installed a lathe they are ready for anything. Rather they should take the view that they have provided themselves with the means to make the equipment which will enable them to tackle practically anything. The potentialities of a lathe are almost boundless, but it must be provided with well made accessories.

STUB DRILLS

(*Continued from page* 105)

question of best quality drills not being accurately ground during manufacture, the lips sometimes show rather deep grinding marks and the finish of the cutting edges may be improved by a subsequent grinding operation in the workshop, carried out either free-hand or in a drill jig according to personal preference.

In the experience of the manager of a large engineering works, commercial drills are not always accurately ground and may require regrinding before being put into service. In some workshops, too, new drills are reground, and those shown in the accompanying illustrations have all been treated in this way; and it is interesting to note that in some of the drills one lip had to be ground down for an appreciable distance before a symmetrical point was obtained. As it happens, the "Duplex" type of jig, recently described in THE MODEL ENGINEER, is used for this purpose. This jig is made to take the ordinary ½ in. dia. drill, 6 in. in length; but it will also accommodate a ⅝ in. dia. stub drill, and the form of lip gauge fitted will accurately locate the cutting edges during grinding.

When regrinding new drills in a reliable jig, any inaccuracy of the original point form is at once shown up by the extent of the fresh grinding marks.

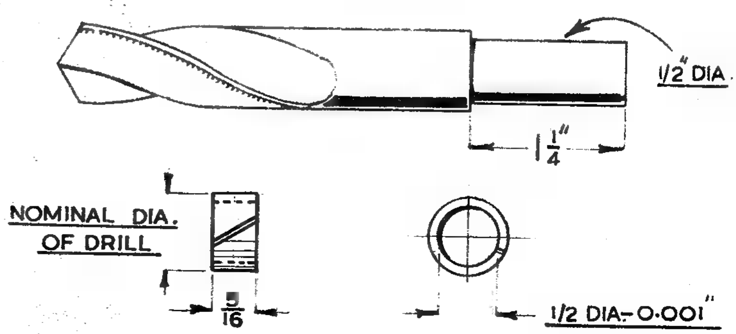


Fig. 3. Method of fitting the grinding collar

Workshop uses for rubber

By W. M. Halliday

NATURAL rubber is not commonly regarded as an engineering material. Despite its numerous unusual advantageous properties of good resilience, durability, and its low cost and ease of working, and the various useful forms in which it may be obtained, surprisingly little use is made of the material in the average workshop.

Three very effective ways in which ordinary rubber hose (such as will usually be found lying around in most workshops) may be employed to simplify and safeguard certain common operations are here described and illustrated, to indicate some of the economical practical applications possible.

A Screw Retainer

When set-screws have to be inserted into very deep but narrow recesses, wells or grooves formed between or in the walls of a component in the manner shown at Fig. 1, considerable difficulty may be encountered. It will not be possible for the operator to place the screw in position with his fingers to start it in the threaded hole at the bottom of such a deep restricted groove. Thus some means will be required to retain the screw to the screw-driver blade whilst being manipulated into such a restricted position.

To accomplish this latter requirement, various simple dodges may be adopted, but which will be only partially successful. For instance, the head of the screw may be liberally smeared with some sticky substance, *i.e.*, thick grease, shellac, etc., so that it will adhere to the screw-driver blade. Alternatively, the critical tip of the screw-driver blade may be split, by a saw cut, midway in its length. The side portions would then be sprung outwards in opposite direction a slight amount, so that the awry portions would then grip tightly against the sides of the slot across the top of the screw head.

The dodge is extremely messy, and will only be effective with very small light-weight screws. The second method means damaging and weakening the working end of the screw-driver blade, thus impairing it for normal working purposes. The split tip will be more liable to break when tightening up screws.

A much more effective and simpler method of overcoming such frequent difficulties is shown at Fig. 1. This incurs little expense or trouble and the screw-driver blade has not to be altered or weakened in any way. This is plainly illustrated in the sketch where *a* is the cheese-head screw which has to be threaded into hole *b* in the floor of the deep narrow groove *c* machined in the wall of the work-piece *d*.

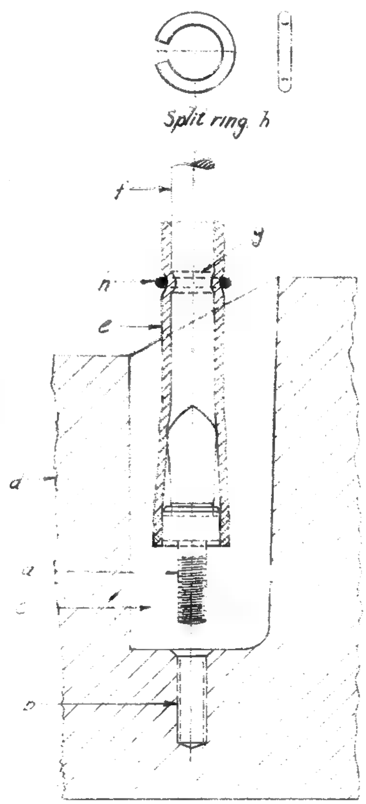


Fig. 1.

A short length of ordinary rubber hose *e* having a bore slightly smaller than the screw-driver blade *f*, is pushed over the working end of that tool, allowing the end to project beyond the tip of the tool for slightly more than the height of the screw head, as shown.

Normally, the rubber tube will grip tightly on to the blade, provided a sufficient length of contact is maintained, and its bore is approximately $\frac{1}{16}$ in. *less* than that of the blade. In cases where only a very short length of rubber hose can be employed, and where additional gripping pressure is desirable, this may be obtained very simply by machining a shallow wide annular groove *g* around the blade. A circular split-ring clip *h* is then pressed over the outside of the hose to be situated above the groove. The spring pressure of the clip will press the walls of the rubber hose into such groove and so maintain the piece smartly in place.

Such a spring clip may easily be made by cutting off a single coil from a compression spring, as shown in the small sketch. Another effective and simple way would be to wind two or three coils of fine copper wire around the hose to press the walls into groove *g* in the same fashion. A spring clip will be best, however, since removal of the rubber hose would then occasion no trouble.

To use, the screw is simply inserted, head foremost, into the bore of the rubber hose projecting from the tip of the blade. The latter portion of the blade will, of course, be engaged in the slot across the screw head so that positive turning pressure may be applied to the screw immediately it is engaged in the threaded hole.

In this manner the screw will be strongly held to the screw-driver and may very easily be manipulated to place it in very deep slots, etc.

After the screw has been tightened into the work, a sharp upward pull on the screw-driver will suffice to withdraw the tool, complete with rubber hose from the fixed screw.

This little dodge is very inexpensive and simple to adopt, and will deal with almost any shape, and a large range of screw-head sizes. When required, the rubber hose may be instantly withdrawn from, or applied to the screw-driver blade without the need to use any sort of tool, etc.

One good plan to ensure that the rubber hose will always be available when required to meet a sudden emergency is to retain it permanently on the screw-driver when not in use for holding screws as described. For this purpose, it will simply be pressed up the blade to bear against the handle ferrule, a expos-

ing the working end of the blade tip for all normal screw-turning work. Located in this position on the blade, such [redacted] rubber sleeve would constitute [redacted] useful additional handle grip when using the tool with dirty or oily hands.

Avoiding Injuries

Numerous hand and finger injuries commonly arise when using the ordinary bench vice. The operating handle-rod being [redacted] very slack fit in the lead-screw knob is often liable to drop very sharply and to cause the user's fingers to be trapped between one of the end stop-collars on the rod and the sides of the knob. prevent the edges of the stop collars *d* becoming bruised, torn and ragged due to the constant forcible contact with the sides of the knob. Normally the edges of such collars become sharp, and mushroomed over, which portions are liable to cut the hands of the operator.

A Rubber Stop

Yet another very practical and useful application of rubber is in connection with the ordinary trepanning tool, as employed for cutting large diameter holes in sheet stock, etc.

When using such a tool, especially with soft metals, such [redacted] copper, side of the sheet, etc. This may be accomplished very effectively by employing [redacted] piece of ordinary rubber tubing in the [redacted] illustrated at *B*, Fig. 2.

With this diagram, *a* is the thin sheet stock to be trepanned by cutter *b* for [redacted] large diameter hole. The tool and cutter [redacted] guided concentrically by the integral pilot stalk *c* which rotates in [redacted] small hole previously drilled in the stock. A rubber pad *d* is cut from [redacted] piece of hose and is interposed between the top of the work and the underside of the circular disc body of the tool. The rubber tube should have [redacted] bore slightly less than the diameter of the

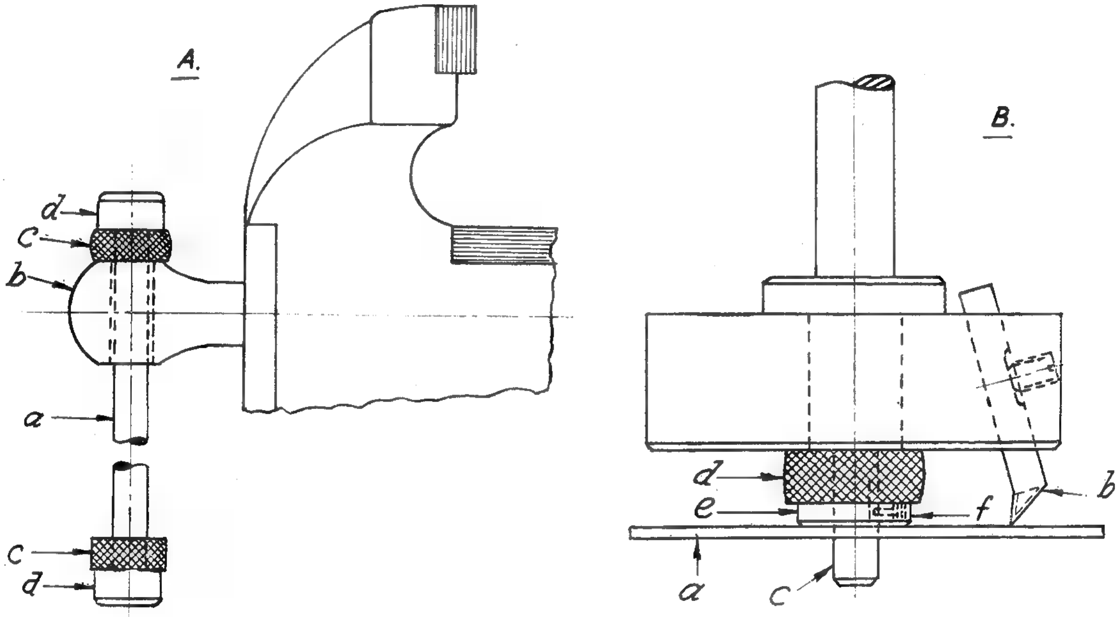


Fig. 2.

To avoid such risks, two short lengths of rubber hose can be used with great advantage, as shown in the attached diagram *A*, Fig. 2. With this diagram [redacted] is the handle-rod situated in knob *b*. Encircling the rod at each end is [redacted] thick piece of rubber tube, *c*, the bore of which should be slightly smaller than the diameter of rod *a*. Each rubber piece is situated immediately underneath the stop collar *d* affixed on the ends of the rod [redacted] shown.

If the handle-rod should accidentally slip out of the hand when adjusting the vice, the fingers cannot be trapped sufficiently hard to cause injury of any kind, since the soft rubber will cushion the blow.

This simple provision will also zinc, or aluminium, and where the material is thin, troubles often occur in respect of the tendency of the single-point cutter to snatch into the material whilst being fed. Moreover, with the same materials, great care will be required when the trepanning cutter breaks through on the underside. If the down pressure on the tool is not carefully adjusted at this stage, the tool may dig in and jam, so whirling the sheet stock out of the operator's hands, or shifting it in the fixture.

The most effective way to ensure smooth trouble-free cutting with such trepanning tools is to employ some means for ensuring a regular feeding pressure, and one which will instantly adjust itself in reducing fashion when the cutter breaks through the under- pilot on which it should be smartly pressed. For preference, the rubber pad should have [redacted] thickness of not less than four times that of the material sheet being trepanned.

A hardened steel washer *e* about one-third the thickness of the rubber pad is also mounted on the pilot underneath the pad, so as to be in contact with the top surface of the work. This washer has a small peg *f* affixed in one side, which passes freely into [redacted] shallow elongated slot machined in the side of pilot stalk, [redacted] shown by light broken lines. This ensures the washer will rotate with the tool, but will be free to slide along the pilot [redacted] sufficient distance to give the necessary compression to the rubber pad.

(*Continued* [redacted] *next page*)

PACKING FOR THE FACEPLATE AND CHUCK

By W. J. Saunders

WHEN boring some jobs on the lathe faceplate or chuck, it is necessary to use packing-strips in order to allow for the boring tool to complete its traverse through the work. It is rather a tedious job to manipulate the packing-pieces, and if a number of similar jobs require boring, it means adjustment each time. In order to overcome this difficulty the following method of packing is well worth trying. The use of fixed packing-pieces on the faceplate is indicated by Fig. 1. The pieces are held in position on the faceplate by means of countersunk bolts, as indicated at *A*, Fig. 1. Pieces of broken piston rings make good packing, and in Fig. 2, a piece is indicated at *A*, drilled and countersunk ready for use.

An alternative method is to drill, tap, and drive a stud in the packing as indicated at *B*, Fig. 2, and these are held in position by nuts and washers.

A very good practical method of securing the packing-pieces to the jaws of a chuck is indicated in Fig. 3 The pieces which are indicated at *A*, Fig. 3, are held to the jaws by means of plate clips. The packing-pieces are quite easy to make. Details of the pieces are given in view *A*, Fig. 4, the packing-piece being indicated by *B*, to which the plate springs *C* are attached. The plate springs are cut and shaped from sheet brass as indicated, the dented portion being formed to obtain a nice spring grip on the jaw sides.

The plate springs, when formed, are secured to the ends of the packing-pieces by means of small screws, as clearly indicated. The packing-pieces are clipped on to the jaws of the chuck, as indicated in view *B*, Fig. 4. This method is far better than adjusting the loose packing-pieces, especially if repetition work is on hand.

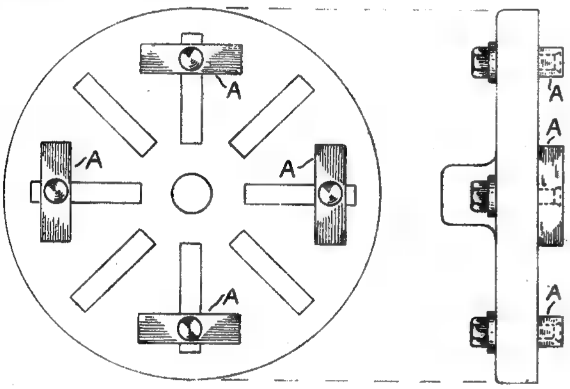


Fig. 1.

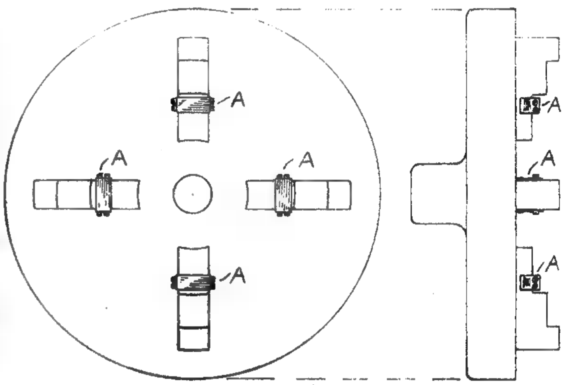


Fig. 3.

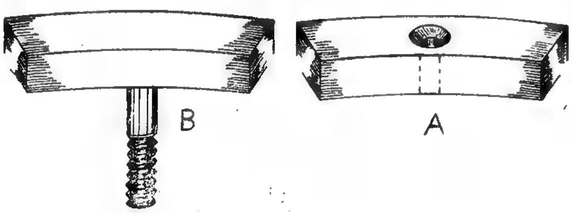
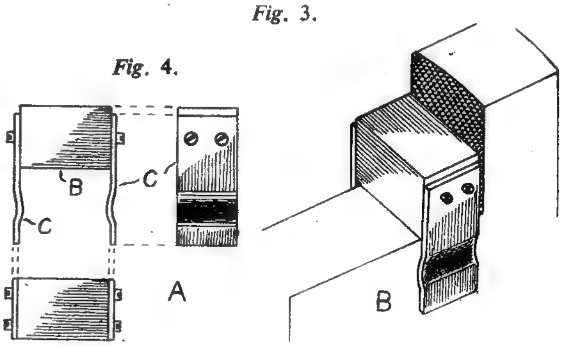


Fig. 2.

Fig. 4.



Workshop uses for Rubber

(*Continued from previous page*)

In operation, the cutter *b* is adjusted so as to commence cutting on the work-piece when the rubber pad has been very lightly compressed. As the cutter penetrates into the material, some of the downward pressure on the tool will be absorbed by the compressed rubber pad, thus a much smoother cutting action will result. When the cutter starts to break through, down pressure may be released slightly to allow the expanding action of the compressed rubber pad to complete the feed, which it will do in a very gradual and far more safe manner.

Where a variety of trepanned work has to be performed on a range of different hole sizes, it will, of course, be advisable to provide a number of rubber pads, of different lengths and diameters, etc., to suit the various forms of work.

READERS' LETTERS

■ **Letters of genera linterest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter The Managing Editor does not accept responsibility for the views expressed by correspondents.**

SERIOUS TOPICS !

DEAR SIR,—Congratulations on the "Smoke Ring" entitled "A Little Nonsense Now and Then" in THE MODEL ENGINEER for December 25th, 1952, which did just what it was intended to do.

I would like to express my appreciation, which, I am sure, is also shared by the vast majority of readers, on the article entitled "A First Attempt," appearing in the same issue. Mr. Oxley is a humorist, in a world, apparently, of his own. Where has he been hiding ?

We all look forward to the time when, after the completion of his present researches in the world of atomic physics, he will be in a position to make known to us his findings ; and, I may add, we sincerely hope that you, sir, may be prevailed upon to think better of your present determination to suppress his contributions to science !

Yours faithfully,
Penzance. ARTHUR G. HANN.

LOCOMOTIVE HEADLIGHTS

DEAR SIR,—Referring to the point raised in "Smoke Rings" by "Progress" regarding headlights for British locomotives, I have fired the "Night Scotsman" non-stop from Newcastle up to London and Kings Cross back to Newcastle on a number of occasions, and I heartily endorse your comments.

"Progress" should go to Kings Cross and see the train leave. The two engines diagrammed to work the train on alternative nights, A1. Class 60154 and 60155, are fitted with very powerful electric headlamps. On this run a great many trains pass on the up road coming to London, E.P., O.P., meat, fish, and fast braked trains, and I doubt if the runs in America have to contend with so many passing trains, the majority fitted with electric headlights. The glare from these headlights often momentarily dazzles the driver and fireman, causing the driver to lose vision of approaching signals. In certain parts of the road the signals are in very close proximity to each other.

I have also been informed that lights fitted on American engines are there so that the driver can see a good stretch of the track, as the American permanent way is not laid in the same way as ours.

I am a member of the Tyneside Model Society and I am building a ¾-in. scale L.N.E.R. 4-6-0 B1 *Springbok*. I work at Gateshead shed and we have eight B1 class stationed here, so if I am stuck on anything I can go and have a look at the real thing.

We also have about 100 passenger and mixed traffic engines here. A1, A2/3, A3, A4 and V2 class, so when I am finished B1 I will have a good selection to pick from for the next. All Gresley's engines look well and work even better, that is more than I can say for the later models.

Yours faithfully,
Gateshead. G. T. JENNINGS.

EYE PROTECTION

DEAR SIR,—Some form of eye protection is a wise precaution when turning work in the lathe, but a glass lens has some disadvantages due to its fragility.

Now that lenses can be made in plastic material, these offer an ideal safeguard, and for those who do not normally wear spectacles a plano "lens" can be fitted.

I hope this letter will contribute to the safety of fellow model engineers.

Yours faithfully,
Falmouth. HAROLD V. EDDY.

PARTING OFF

DEAR SIR,—I read with interest and some surprise the views expressed by Messrs. Raglan Engineering Co. on the subject of "Parting Off."

The practice of parting off from the rear of the lathe cross-slide is not the outcome of anyone's "impressions" that it is more satisfactory, neither is the practice maintained by reason of Messrs. Raglan's supposition that the rear toolpost is usually of reasonably robust construction.

It would be far more accurate to say that on the majority of production lathes and capstans the rear toolpost is far less robust than the front ; it is also always at least a tool depth higher.

Parting off from the rear is no haphazard choice nor fad of the individual operator, neither do machine tool manufacturers arrange for parting off to be positioned at the rear of the cross-slide from associations with "Old Spanish Customs."

The fact is that the rear toolpost has the one quality that is essential for satisfactory parting off and that is, any flexibility in the toolpost, slide or work tends to spring the tool away from the work, whereas, any flexibility in a front tool post, tool or work will cause the tool to feed into the work with the usually disastrous effects with which many are acquainted.

Two other factors contributing to the advantages of the back toolpost are that the load imposed on the mandrel during cutting has a downwards direction and does not tend to lift the mandrel against its own weight, and secondly that the swarf or chips fall away from the tool instead of staying on top to shield the tool from lubricant and of jamming in the cut.

Successful parting off can, of course, be obtained from the front toolpost, provided every means are taken to maintain absolute rigidity in the toolpost, the cross-slide, the tool, the mandrel and, in fact, the whole box of tricks.

The lighter the lathe and the higher the centres, the more elusive these essential qualities become.

Whilst the most exacting requirements are usually met for normal machining on small lathes, I feel it a little unfair to expect to do serious parting off from a front toolpost.

Yours faithfully,
Maidstone. E. G. RIX.

THERMOMETER SCALES

DEAR SIR,—The article by your contributor, Mr. S. F. Weston, in the December 25th, 1952, issue, reminds me that there is one temperature which reads the same on both Centigrade and Fahrenheit scales. Perhaps some of your readers would care to amuse themselves working it out from the formula Mr. Weston gives.

Yours faithfully,
Alnmouth. C.G.S.B.

A model lifeboat

IN a letter from Mr. George H. Green, the builder of the model lifeboat shown in the accompanying photographs, he says.

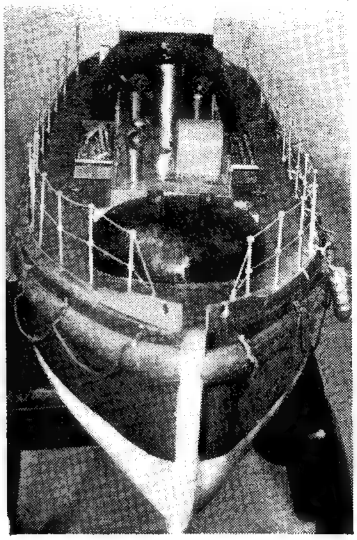
"This is a model of the Penlee lifeboat, *Penzance*. The hull design was taken from a plan issued as a supplement to the *Model Yachtsman* in January, 1931. These plans were modified to fit the engine and to conform in detail with the Penlee lifeboat. The model is 47 in. long, and has a beam of 13½ in.

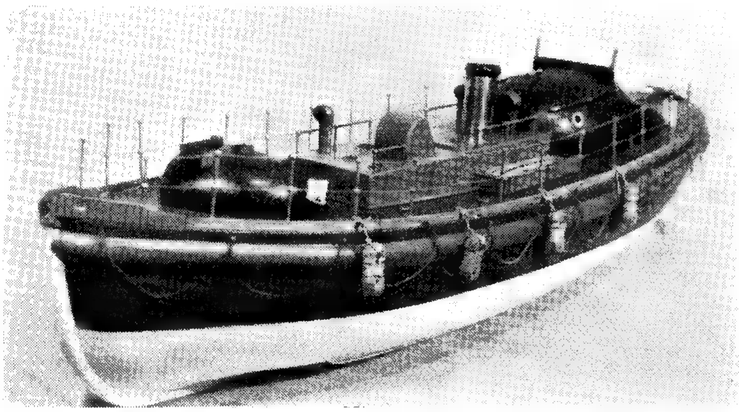
"My son and I built the boat from sketches made on this lifeboat while we have been on various holidays in Cornwall. The model, which is built to the scale of 1 in. = 1 ft., took two years to complete. The hull was double planked of ⅛ in. spruce and the tunnel stern was carved from ½ in. thick wooden blocks glued together with synthetic resin glue. The hull is finished in lifeboat colours, white bottom, blue sides, with red fender band. The decks are grey. Inside, the cabin is fitted with mahogany lockers and scale wireless equipment. The fore shelter is also fitted with mahogany lockers, axe and fog horn. The curved roof of this and the after cabin were built on a wooden former with ribs and two diagonal skins of $\frac{1}{16}$ in. wood, the under layer of spruce and the upper layer of mahogany.

"The top skin of the after cabin consists of 100 separate planks, steamed, glued and cramped in turn—entailing six weeks' work. The inside of the after cabin is fitted with correct controls. As we have no machine tools, all the equipment has been made from scrap, such as screws, washers, curtain rings, etc.

"The dummy engine controls in the after cabin consist of two throttles made of wireless terminals, two reverse wheels made of curtain rings, oil pumps and panel with seven dials for each engine. Also on the control panels are fire extinguishers and a searchlight.

"The steering wheel was made of 2-in. curtain rings, and was drilled by hand and fitted with ⅛ in. brazing wire spokes. The bush was out of an old Meccano wheel. The pinion on the steering wheel spindle turns the rudder through a quadrant, which was a piece of a magic lantern slide.

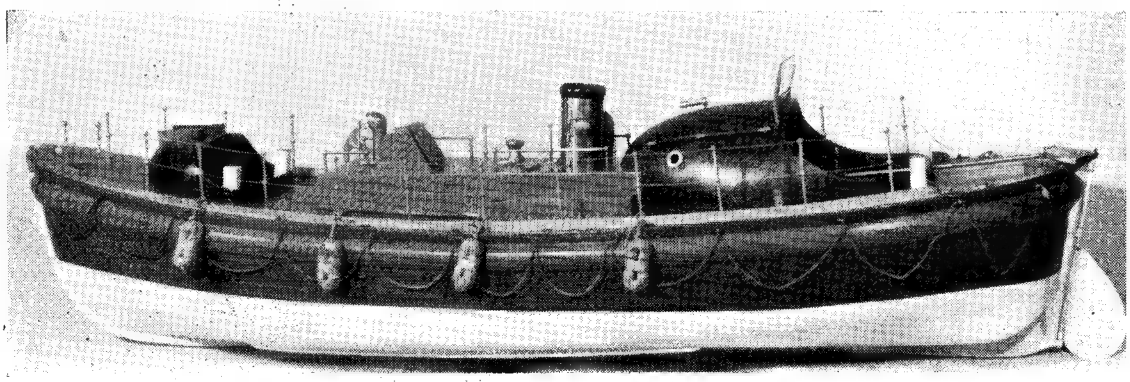




"The 'fiddley', which is removable to get at the engine, was built out of sheet brass, and the hatch to wireless room is hinged. The capstan is made of part of two bedstead knobs, siren from the spout of an oil can, and port lights were cut from king-pin bushes of a car. The three ventilators were beaten and soldered out of nine separate pieces of brass. The stanchions are made of brazing wire, the 52 balls being turned and filed in the chuck of a breast-drill.

"The engine is a modified 'Wild Cat' diesel. A brass cylinder-head was made by a friend, and a water jacket was fitted. The water is impelled up a pipe placed in the slip-stream of the propellers.

"The fuel tank is fitted through a brass plate in the deck. This engine is fitted with a 14 oz. flywheel and gives the boat a steady scale speed."



A perpetual calendar clock

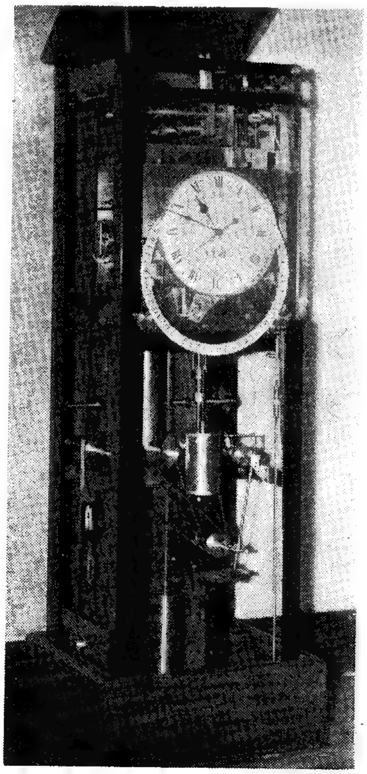
By W. H. C. Bradley

IN September, 1948, I was invited by the late Dr. J. Bradbury Winter, to visit him at his home in Coniston, to discuss my recently completed "Congreve" clock, which had been constructed to his designs published in THE MODEL ENGINEER during early 1946, and after a most enjoyable discussion, the doctor suggested that I should inspect his latest design of chiming, striking and calendar clock, which was then under construction.

Whilst closely examining the movement, the doctor suggested that perhaps I should like to attempt the construction of a similar one for myself, and on receiving my reply in the affirmative, readily promised that he would forward all drawings and instructions to my home at Giltbrook, Notts, on my return. The fact that 200 miles separated the designer and the constructor, was of no consequence to him and the promise of forwarding the necessary drawings, etc., was soon fulfilled, as can be seen in the accompanying photographs, the results of 3½ years of most enjoyable and interesting work.

This clock has many unusual features; quite a number are entirely original, and others are based on the clock designed and constructed by Dr. Winter in 1935-37, and described under the heading "Some Notes on a Wonderful Clock" in THE MODEL ENGINEER in May, 1937.

Below are given briefly, the features and general description of my clock.



The outer casing removed

The Dial

Approximately 10 in. in diameter, it contains four apertures, through which can be easily seen, the date, day of the week, month and years, the figures, etc., being mounted on revolving rings or drums, all their movements are automatically controlled by the calendar and clock mechanism, and all changes are timed to take place in the night. The calender mechanism also selects automatically the 30-day months, together with Leap Year, thereby always showing the correct date and day, no alterations or adjustments by hand, therefore, being required.

A centre-seconds hand, in addition to the usual hour and minute hands, is also fitted. Perhaps, at this stage, the revolutions of the various drums may be of interest to readers, and are as follows :—

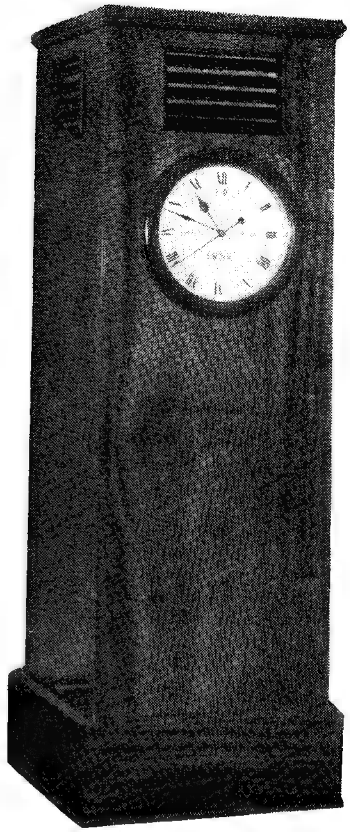
Day of the week drum—once per week.

Day of month ring—once per month.

The month's drum—once per year.

Years units drum—once per 10 years.

Years tens drum—once per 100 years.



The clock complete

The Clock Movement

This employs three geared trains the going, strike and chimes, and the necessary levers and mechanism for correct working and the letting off of the strike and chime, fully adjustable gathering pallets being used for ease of setting.

The escapement is of the Graham dead beat type, the pallets being independent and adjustable in the form of arc-pieces clipped to the hefty holder.

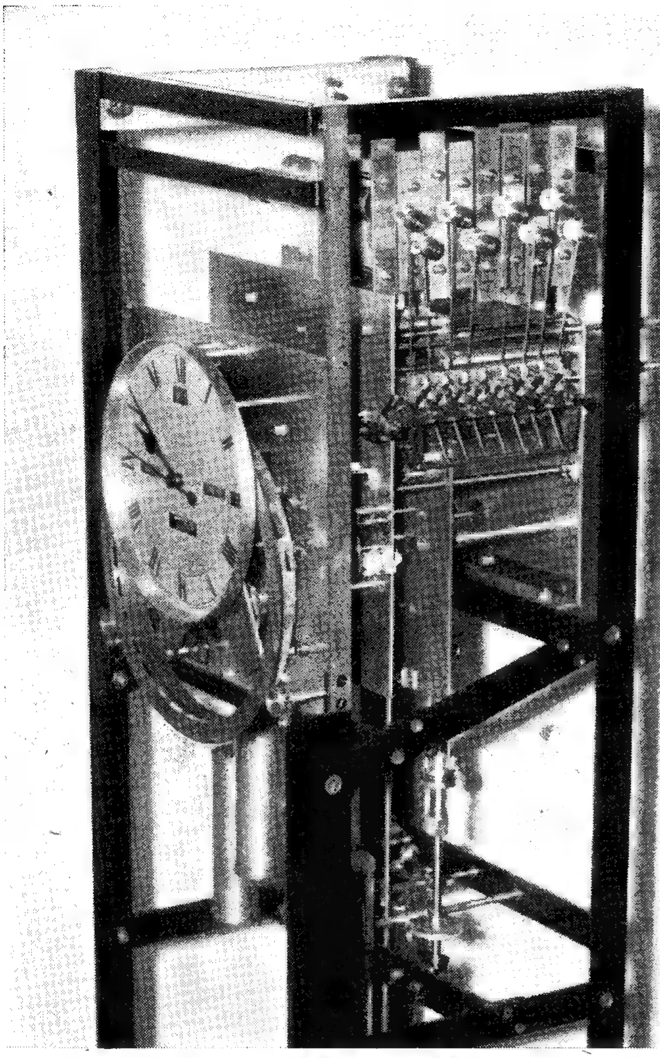
All weight barrels are fitted with double "clicks," and all weight lines are of steel cable, and brass casings are used for all weight cases, with a final lagging of Russian iron.

A seconds pendulum, of "Invar" steel fitted with an 8 in. × 2¾ in. steel bob, fully adjustable, is employed.

All gearwheels and pinions, ranging from 162T. to 12T. were cut in the lathe by means of a suitable attachment.

The Chimes

These are sounded by piano hammers on brass gongs in con-



View showing the chiming gear on Mr. Bradley's clock

junction with their $1\frac{1}{4}$ in. resonating tubes, eight in number, and covering the full octave in the key of A flat. Seven sets of chimes are used, one for each day of the week, automatically changed during each night, the idea being that each day should have its own distinctive tune, these being Westminster, Carfax-Oxford, Three Fishers, and Whittington, the rest being of the designer's choice.

Silencing mechanism is also fitted to the strike and chime, and automatic chime rectification mechanism is used. The chimes barrel contains 370 pins, and was built up from 2 in. brass tube.

The Hour Strike

This is also by piano hammer, using two piano wires, both tuned fo D flat in the bass, giving a deep resonating note, the wires extending the full depth of the clock case.

The Winding Gear

This automatically winds all three weights every 12 hours, by means of vertical shafts and worm gearing, a small electric motor being used. The weights themselves control the switching on and off of the power to the motor, and all switches used are of the mercury type. The motor's revolutions, during winding, are counted by an ingenious device geared down to the ratio of 2,500-1. This mechanism is also connected into the motor circuit, and acts as a safety control should the normal means fail. The whole clock movement and winding gear, is housed in a stout chassis of $1\frac{3}{4}$ in. $\times$ $1\frac{3}{4}$ in. $\times$ $\frac{1}{4}$ in. angle steel, suitably braced, which forms a rigid frame for all the mechanism and also the case.

The Clock Case

This is made of Spanish mahogany $\frac{7}{8}$ in. thick, and stands 4 ft. 11 in. high. The front and both sides are made as panels, held to the steel frame by suitable interior catches, which enable them to be easily detached for inspection of the interior mechanism, this method is used to avoid any screws showing on the exterior of the case. Louvres are fitted to each panel to let out the musical sound. The lid, which closes the case, is fitted with much ingenious mechanism, as access to the clock can only be gained by opening this lid, and this is controlled by a locking device depending on a secret sequence of the movements of the lid, which limits the opening to those who know the combination.

A further mechanism is provided to unlock this gear in the remote event of failure. The whole clock is supported on four jacks which easily enable the clock to be lined up. In conclusion of this very brief article, I would like to pay tribute to the genius of its designer, the late Dr. J. Bradbury Winter, whose help and advice was always freely available, often under conditions of great difficulty, and without whom this most ingenious mechanism would not have been possible; also, to express my thanks to my friends for their interest and help during construction.

The photographs were taken by R. H. Hodges.

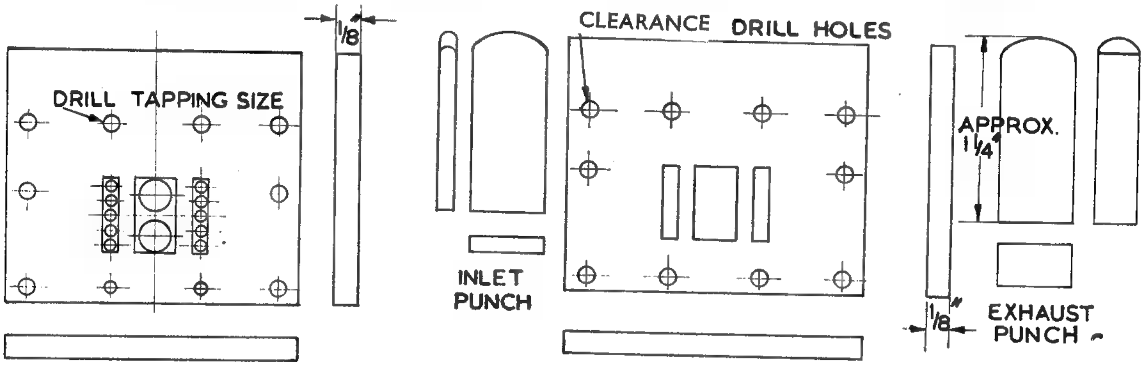
VALVE PORT CUTTING SIMPLIFIED

By "L.N.W.R."

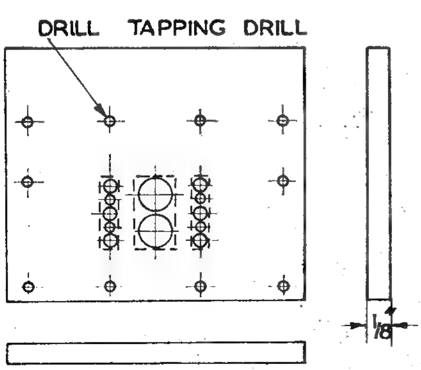
THE most difficult part in machining a pair of locomotive cylinders, or any others, is, without a doubt, in cutting the ports in the cylinders, and the valve cavity, as the efficiency and general performance of the locomotive or engine is dependent on the ports being dead to size, and true. Mine are dead right to within 0.001 in. with the aid of drill jigs, dies and punches, which are quite easy to make and can be used over and over again.

To make the jig and die for the ports, file up two pieces of 1/8-in. dead square and true to the size of the port face. (Reference to *Tich* cylinders, for which the tools were made, will be of great help in following this article.) Now mark out the port openings with a height gauge, putting a centre-line both ways through each port and also the valve-chest screw-down holes. If a height gauge is not available, a square and rule should be used but not without a watch-maker's glass. It is surprising how close one can get with its aid. Drill the screw holes to tapping size and the port slots, as illustrated, using a small drill and open up until the holes are just inside the lines. The lower of the two plates clamped together is the drill jig. The first plate marked out is the die. Proceed to file the holes into elongated slots so that the lines are only just visible. At this stage it is as well to make the punches. These are made of steel, dead to size and square. The heads may be a little undersize. Harden and temper. To finish the die, gently ease the punches through the die-head first so that they are a good fit and in order that the cutting edge of the punch will just slide through without any slop either side to side or end to end. The glass should be used to get the slots true with the lines. Drill out the screw holes to a tight clearance size and clean off the burrs.

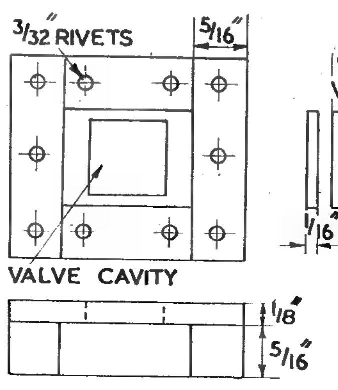
To use drill jig, clamp to the port face accurately with the bolting face and ends, using toolmaker's clamps, and not forgetting to include some card to prevent damage to the bore. Drill the port holes and screw holes to a shade under depth and finish with D-bits to complete depth. Remove the jig, tap screw holes with the necessary tap and chip the port holes into rough slots. Gently ease off burrs and screw on the die. Mark out the ports by using a thin scriber inside the ports. Remove die and chip out the slots as near as possible to the lines and clear out the bottom. Replace die, insert punches one at a time and gently tap down, cutting the port slot. It may be necessary to remove the jig once or twice to remove surplus metal. When finished to



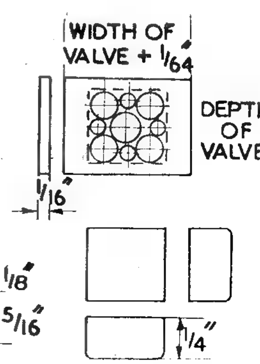
Dieplate



Drill jig



Valve die



Valve face drill jig, and valve cavity punch

the required depth the cylinders with ports are completed to the right size and dead true.

The drill jig is also used for drilling the steam chest and it is as well to mark the drill jig so that it is placed on the port face the same way each time.

To make the valve jigs, file up a $\frac{1}{16}$-in. plate to the size of the valve, plus 1/64 in. on the length. This extra metal is for final adjustment of the valve in final valve setting. This must be square and to size. Using a $\frac{1}{8}$-in. plate, $\frac{5}{8}$ in. larger each way, rivet a $\frac{5}{16}$-in. square rod round its edge, as illustrated, until the $\frac{1}{16}$-in. plate will slide in without shake. Having reached this point, and filed the outside up square, carefully mark out the box jig for the valve cavity, locating from the inside of the $\frac{5}{16}$-in. strips and marking-out on the outside. Having marked out the position of the valve cavity, proceed to position the holes, as illustrated, so that most of the material is removed without overriding the lines. Slip the $\frac{1}{16}$-in. plate inside the box and mark in order that they go together in the same way. Make a wood plug to use in the hole as a drilling pad, and drill the holes. Clean off the burrs from each item. This is the drilling jig. The box is filed out in the same way as for the valve die and a punch mark is made as before. To use jigs, slip drill jig into the box and then the valve, and drill holes a shade under the depth. Finish with D-bits to obtain flat bottom holes. Chip out the surplus metal and put valve into the box. Scribe round the cavity and finish off in the same way as the port slots. The punch can be squeezed in with the bench vice, and in this way an even pressure is kept all over the punch. Be careful not to damage the edges of the valve when chipping out the cavity. When finished, both cylinder and valve will be the correct size and true.

It may be, or seem to be, a long way round to do the job, but there is the satisfaction of knowing that when finished it is correct, and the cylinders will do the job they were designed to do.

The tools will now be ready for the next time or can be used to help out a fellow modeller or club-mate.

AN INTERNAL COMBUSTION STEAM GENERATOR

By H. W. McKernan

WHILE thinking of the various ways of converting potential energy into actual power, it has often occurred to me that in spite of its rivals, steam is still the best working fluid for the prime mover. The steam turbine is, I believe, the most reliable form of prime mover, the power plant engineer's chief troubles arising from the boilers.

I have often thought that if a more simple plant could be devised for generating steam, the usefulness of the steam turbine would be greatly extended. It was while thinking on these lines that a possible method of steam generation occurred to me, and while I very much doubt its practicability, it has been an interesting subject for speculation.

The chief factors which brought the idea to my mind were the underwater cutting of steel, by means of the oxy-acetylene, or oxy-hydrogen cutting blowpipe, and the combustion chamber used in connection with the gas turbine.

If an oxy-hydrogen flame can be made to burn while submerged in a considerable depth of water, it should be possible to maintain combustion in an enclosed chamber containing medium pressure steam.

The steam generator consists of a cylindrical vessel, enclosed at one end and tapered off to a narrow outlet at the other, the vessel being surrounded by a water jacket. In the centre of the closed end is an oxy-hydrogen burner nozzle, this having a hood forming an annular space round the outside of the nozzle, through which the compressed air can be blown to form a shield round the flame.

Round the burner nozzle several water spray nozzles are arranged, through which hot water from the water jacket can be pumped; the spray entering the chamber should flash into steam, and by the time it has travelled the length of the chamber, be superheated and would, with products of combustion, pass at high velocity through the outlet.

Pressures would be low, but it might be possible to achieve the high velocities necessary to drive a steam turbine. As I have already stated, I am extremely doubtful of the practicability of the idea, but if it was a feasible proposition, it would offer several advantages over the steam boiler.

Some of these advantages would be:—

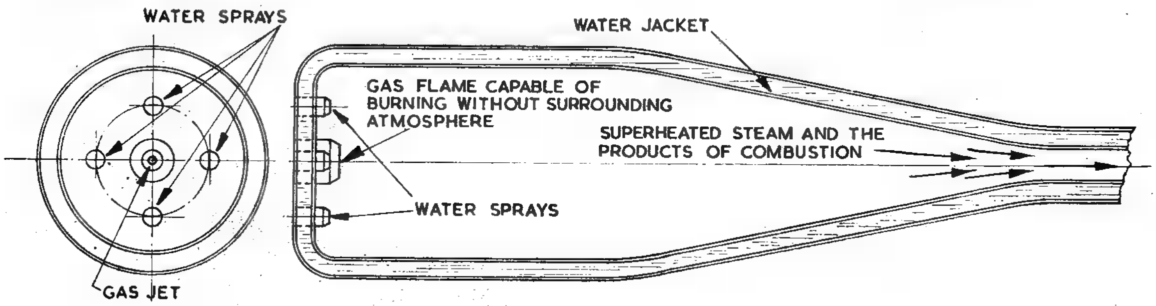
(1) Safety: an increase in pressure in the chamber would automatically retard the flow of gas and water spray from the nozzles.

(2) Compactness: the generator could be coupled direct to the turbine.

(3) Availability: the plant could be started up at very short notice.

(4) The arrangement should be economical, the heat gathered by the water jacket being returned to the chamber *via* the spray nozzles, the exhaust from the turbine being passed through a condenser and the condensate pumped back to the water jacket. The chief loss of heat would be *via* the condenser cooling water.

The chief apparent disadvantage is that the generator would require oxygen and the cost of this would probably make the idea uneconomic, even if it was practicable.



The viscosity of i.c. engine fuels

By R. E. Mitchell

THE fuels at present in use for two-stroke internal combustion engines, particularly when using glow plug ignition, consist mainly of methanol with varying amounts of castor oil as the lubricant. The quantity of oil may vary within wide limits, usually between 10 per cent and 30 per cent. Compared with the fuels used for four-stroke engines, where "petroil" lubrication is not used, these are viscous liquids. The flow of the fuel through the carburettor jet is proportional to the viscosity of the liquid and the amount of oil in the fuel may have a large effect on the jet needle setting to give a correct mixture strength. Also, since the viscosity varies inversely as the temperature, this will also have an effect on the needle setting.

To compare the viscosities of fuels containing various quantities of oil, and at different temperatures, an Ostwald viscometer was used as shown in Fig. 1. The apparatus, which is made of glass, consists of a capillary tube fused at its upper end to a wider tube *B*, which is blown into a small bulb *D* close to the capillary tube. The lower end of the capillary tube is also fused to a wider tube which is bent and provided with a bulb *C*. Two marks *X* and *Y* are etched on the tube just above and below the bulb *D*. It is essential that the space between the bulb *D* and the capillary should be perfectly smooth and regular, and that the tube and joint at the top of the bulb *D* shall be wide enough to prevent drops of liquid hanging.

A known volume of liquid is introduced into *C* by means of a pipette. This is then drawn into the bulb *D* so that the upper level of the liquid is above the mark *D* by sucking at *F* or blowing into the apparatus at *G*. The time required for the upper meniscus of the liquid to pass from the mark *X* to the mark *Y* is then noted. To measure absolute viscosities, the apparatus is calibrated against liquids of known viscosity. The apparatus used had not been calibrated but the time required for the liquids to pass through the capillary will serve to compare the various fuels.

To compare the viscosity at different temperatures the whole apparatus can be conveniently immersed in a water bath and the temperature of the water taken.

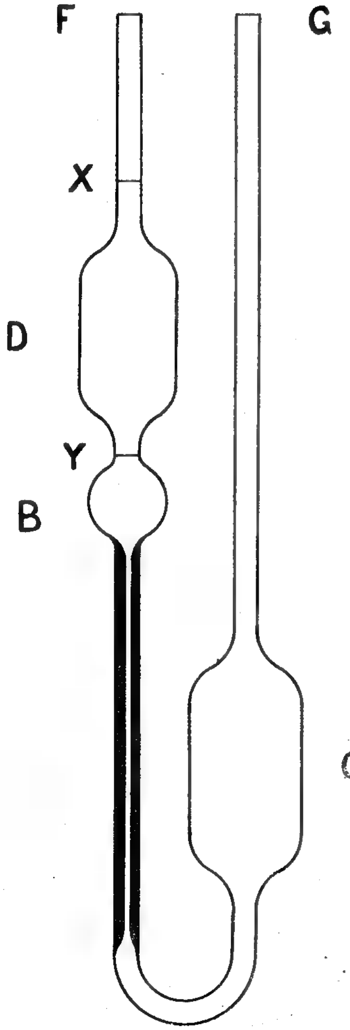


Fig. 1

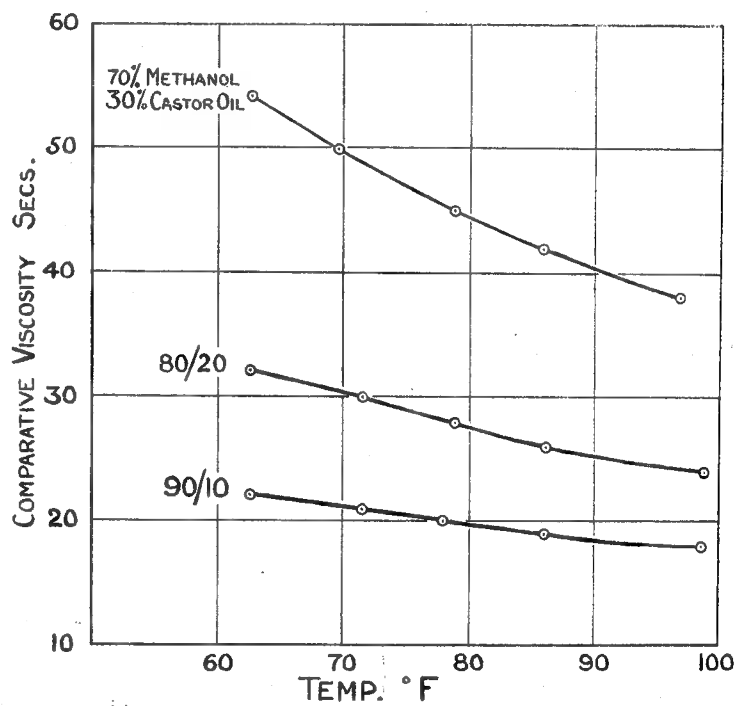


Fig. 2

The table shows the results obtained on fuels containing 10 per cent., 20 per cent. and 30 per cent. castor oil dissolved in methanol at temperatures varying from 62.6 deg. F. to 98.6 deg. F. The results are plotted in Fig. 2.

	Viscosity of Fuel (secs.)		
Temp. deg. F	70% Methanol 30% Castor oil	80% Methanol 20% Castor oil	90% Methanol 10% Castor oil
62.6	54	32	22
69.8	50	—	—
71.6	—	30	21
78.8	45	28	20
86.0	42	26	19
96.8	38	—	—
98.6	—	24	18

From the results it will be seen that the oil content of the fuel has a very large effect on the viscosity of the fuel. Taking the 70/30 and 80/20 fuels at 62.6 deg. F., as an example to make a few calculations. The rate of flow will be proportional to the time taken, hence the quantity of 80/20 fuel that will pass through the jet in a given time will be 54/32 = 1.7 times the amount of 70/30 fuel that will pass through a jet of similar size. Assuming that the castor oil plays no part in the combustion process, the quantity of methanol passing through from the 80/20 fuel will be 54/32 × 80/70 = 1.9 times that taken in from the 70/30 fuel.

This is a very considerable increase in fuel to the engine and will mean a large adjustment to the jet needle to compensate for the difference. It will also be seen that the fuel passed by the jet increases with increase in temperature, but within the limits of temperature encountered in this country the difference is not so great as that found for varying oil concentrations. The difference for 70/30 fuel at 62.6 deg. F. and 78.8 deg. F. is 1.2 times. It will be noted that the effect of temperatures decreases with decreasing oil concentration.

These experiments will serve to show how very important it is to make up the fuel as accurately as possible, and if a fuel containing a different quantity of lubricant is desired, careful experiments should be carried out to find the new jet needle setting. Also, care should be taken to prevent loss by evaporation of the more volatile ingredients of the fuel and so concentrating the oil content. Similarly, it is bad practice to leave fuel in the tank where concentration can easily take place.

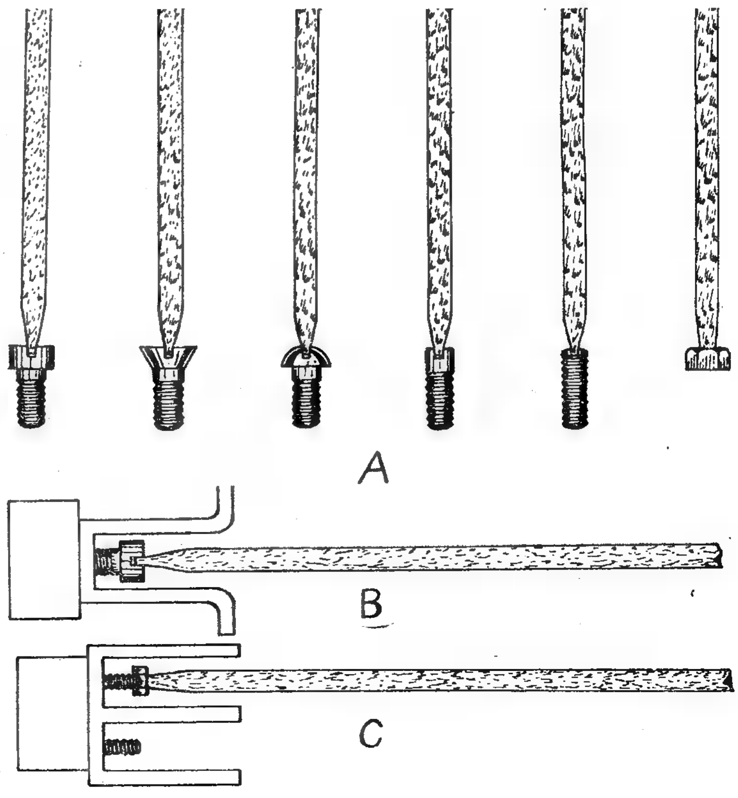
INSERTING SMALL SCREWS

MANY model engineers are often up against it when fixing small B.A. screws and nuts in some part of a model. Once the screw or nut is started it is quite a simple matter, of course, to finish the operation with the small driver, and in the case of the nut, a long-nose pair of pliers or a box spanner. There are quite a few dodges employed for this kind of problem, but if you are not already acquainted with the following idea, it will be well worth trying.

In instrument repair shops and meter repair departments in Electricity Supply Authorities, pegwood is used extensively in starting small screws and nuts in awkward positions. The pegwood or dowel rod will answer the purpose, if cut down at the end to a good fit in the screw-head slot. In the accompanying illustration, view *A* indicates several forms of small screws and grub-screws, also the method of dealing with a small nut.

For the nut, the pegwood is cut down blunt-ended to just fit tight on the first thread. The method of starting a screw in a difficult position such as, for example, a narrow bracket, in indicated in view *B*. The screw is simply started by turning it home a couple of threads with the pegwood acting as a screwdriver. The pegwood having started the screw in position, it only remains to drive it home in the usual way with a small driver.

In view *C* we have a double bracket for example, which is held down by small studs and nuts. The nuts in those case would be difficult to start in position, so pegwood can be used to advantage. The nut is lifted on the end of prepared pegwood as previously stated, and the nut can then readily be started on the thread, as indicated in view *C*. Having started the nut, it can be turned home by means of a box spanner or a long pair of thin-pointed pliers. The idea may also be employed on many electrical jobs such as refitting a small screw in a lamp-holder or switch, or in fact any job where it is difficult or impossible to start the item with thumb and finger.—W.J.S.



UNUSUAL REPAIR JOBS

By H. H. Nicholls

IN the course of repairing instruments and appliances for himself and various friends, the writer has come upon some unusual problems, and an account of how three of these were solved may be a matter of some interest.

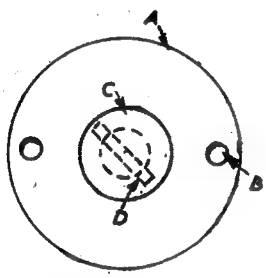


Fig 1A

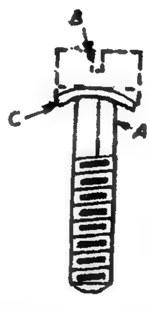
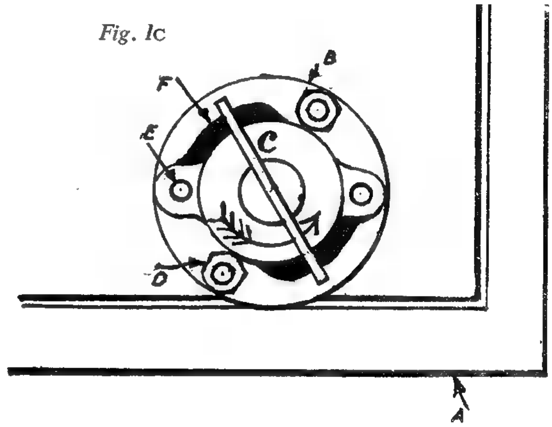


Fig. 1B

Fig. 1C



The first job, Fig. 1, was the repair of a box camera, of which the winder had become shaky, and which moved about on the body of the camera.

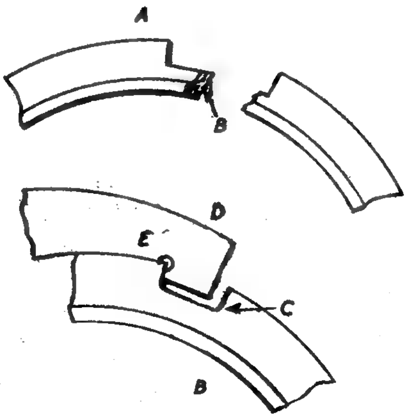
Investigation showed that the camera body was composed of a kind or board of fibre, and the rivets which held the winder had enlarged their holes in the fibre, thus the body of the winder moved.

A previous writer in THE MODEL ENGINEER has described how he found a ten-centime piece of Napoleon III, 1853, used as part of the piston in a model locomotive ; now the writer took one of these, from which the head of Napoleon III and the eagle on the other side, had almost worn away, and put it in the lathe, Fig. 1A ; *a* is the coin, *b* are holes for 6-B.A. screws, *c* a hole bored out to clear the driving dog for the film, *d*.

At Fig. 1B, it will be seen that two 6 B.A. cheese-head screws were put in the chuck, and their heads almost turned off ; *a* is the screw stem, *b* the head turned down very thin, this was then knocked down on each side, forming a shape which would dig into the fibre and keep a firm hold, as at *c*.

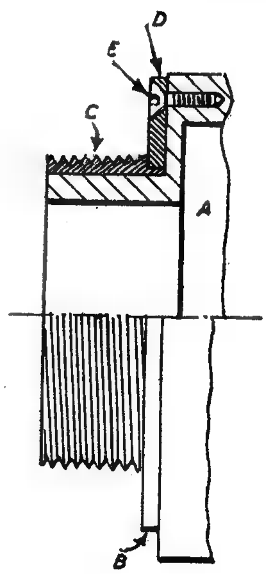
Now, referring to Fig. 1C, we have the repair completed ; *a* is the body of the camera, *b* is the prepared French coin, *d* are nuts on the 6-B.A. screw stems, *e* the holes for the rivets, no longer used ; the body of the winder *c* is very carefully soldered to the coin by solder placed at *f*, to miss the nuts *d* and thus the winder was firmly refixed ; as will be seen, the 6 B.A. screws were put into the sound part of the camera body, away from the old holes.

The second case, Fig. 2, was a Continental camera shutter, held to its panel on the front of the camera, by a ring, Fig. 2A, made of zinc alloy or die-casting metal, with notches *a* to tighten it up. Of course, it broke at one of these notches—a rough fracture shown at *b*. In passing, I might mention that if one uses these locking-rings, if room can possibly be found, they should be made as at Fig. 2B. Here, the letter *c* shows a very small radius at the root of the notch ; *d* is the key, and *e* a very small hole, which forms the root of the projection on the key and at the same time prevents the notches in the ring being damaged or rounded off, as the pull of the key must automatically come well down on the side of the slot—a point worth observing if these rings are used on petrol



Figs. 2A & B

Right—Fig. 2C



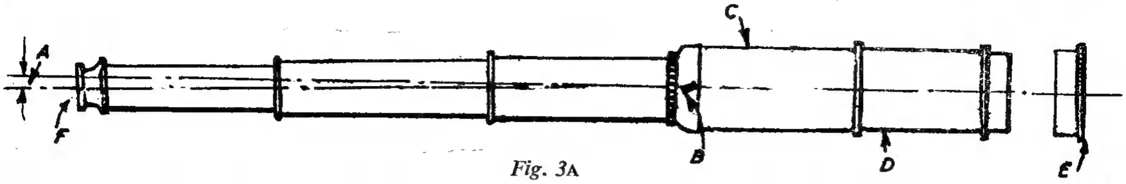


Fig. 3A

engines and other applications, where careful detail work pays. Such a locking-ring is not nearly so liable to break as one which has a sharp corner at the root of each side of a slot or notch.

The special problem with the camera shutter was, how to fix it again, when there was no screwing tackle to match the Continental screw thread, and no special change wheel on the lathe, or access to a machine with metric leadscrew.

The problem was solved thus :

Referring to Fig. 2C, the back of the shutter body *a* was taken out of the shutter, and put in the chuck, then I turned the Continental thread right off, and screw-cut a sleeve, 26 t.p.i., to fit over the spigot left by the removal of the threads, and I made a back-piece *b* which was silver-soldered to the screwed sleeve, here lettered *c*. If there is room, the back-piece may be almost as large as the diameter of the shutter body, as shown at *d*, and this is secured to the shutter body *a* by means of three 10 B.A. countersunk screws *e*.

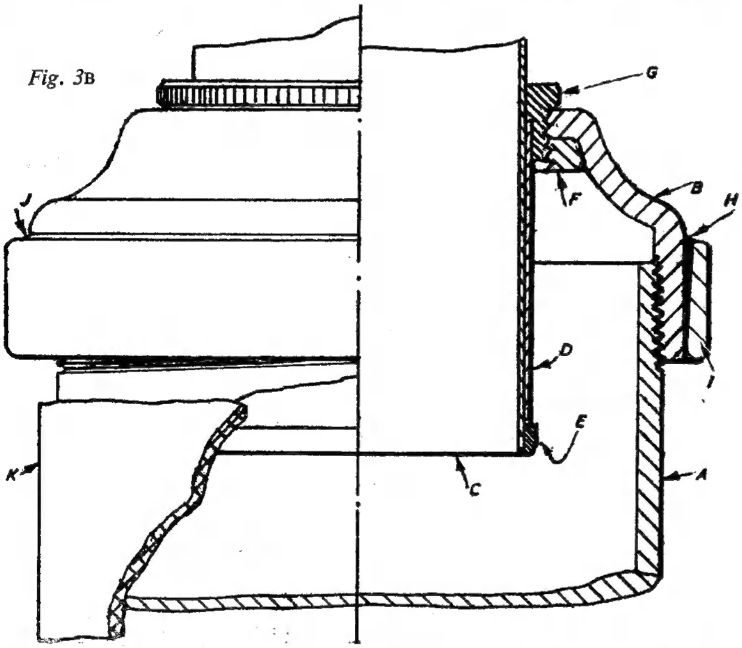
A plain locking-ring was then made, and the repair completed ; the shutter, which, it appeared, would have to be scrapped, was restored to its former place, with no detriment at all to its performance.

The third case was much more difficult. The writer was confronted with the telescope, Fig. 3A, which was a large " pocket " type of glass of about $1\frac{5}{8}$ in. aperture, closing down to a length of about $7\frac{1}{2}$ in., and it had been a good instrument.

The whole thing " drooped," so that the body and the draw tubes were out of line by the amount *a* ; the performance of the telescope was thus ruined.

Investigation showed a crack in the brass work at *b*, while the leather covering had all gone from the body, leaving the discoloured brass tube, *c*. The letter *d* refers to the pull-out " sun and spray " shade—when using a glass of this type, the shade should always be pulled out, which prevents stray rays being reflected from the lens mount, and helps the definition. At *e* is the normal sprung cap which covers the object glass, and *f* is the little pin which moves the kidney-shaped plate which covers the eye-lens. In the case of this telescope, someone had put a steel screw there, so this had to be replaced by 8-B.A. brass. If you put a steel screw here, it only rusts, and hard gritty bits of rust may fall on the eye-lens, with dire results ; if anyone rubs the lens to clean it, a bad scratch may be the result.

Fig. 3B



Now, in Fig. 3B, I show how the instrument was turned into a serviceable article, fit to be used again for many years, and a good telescope is a companion worth having.

The body of the telescope is *a*, *b* the brass collar which had cracked, *c* the first draw tube, *d* the sprung sleeve in which it slides, *e* the stop ring, brazed on, which prevents the draw tube coming out, *f* a ring brazed in to form stiffening for the collar *b* ; *g* is brazed to *d*, and screwed to fit *b* and *f*.

Now the cracked collar was a poor pressing, and any overheating or rough treatment would have spoilt it—and the telescope.

After looking at the job for some time, I devised the following repair scheme. The old lacquer was entirely cleaned off the collar, and the outside well tinned. Then I turned a brass ring, *i*, and bored it taper—about 0.020 in. larger at one end than the correct external diameter of the collar, which fitted exactly when, after wiping off superfluous solder from the tinning, the collar was pushed into the large end of the ring *i*. As it was forced down, the edges of the crack had to approach each other, until they closed up, in order to get exactly the correct diameter at the bottom of the ring *i*. Then a soft solder of " tinman's " quality was applied to the collar and ring, thus forming a conical space filled with solder, as shown at *h*, and externally only a thin line of solder could be seen at *j*. Then the crack being closed, and the thread parallel, this part of the repair was complete.

Now, I mentioned that the covering of the body had gone, and to make a finished job, this had to be replaced.

The body diameter of this telescope was such, that the tube from an " auto-cycle " size tyre would tightly stretch over it, and I found that this material presented a better appearance when turned inside out. This is shown in the sectional sketch at *k*, and the whole instrument could now be considered as restored to a proper working condition.

QUERIES AND REPLIES

" THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked " Query " and be addressed to THE MODEL ENGINEER, 19-20 Noel Street, London, W.1.

Model Power Boat Pond

Please would you give me information on the design of a model power boat pond, also the length of line necessary for running championship races. What is the soundest type of timing apparatus for round-the-pole timing ?

R.P.S. (Parkstone, Dorset).

We recommend that the minimum diameter of the pond should be approximately 50 yards, and the most suitable depth of water is about 2 ft. An irregular shape of pond is preferable to a circular pond, and shelving banks are to be preferred to vertical banks in cases where high speeds are intended.

If it can possibly be arranged, it is a great convenience to avoid excessive depth of water at any point, so that boats can be retrieved from any position without the need for deep-water waders or other equipment.

With regard to the length of line, we recommend, wherever possible, that the laps should be of 100 yards length, though it is frequently necessary to vary this distance owing to the limits in the sizes of ponds. For this reason, there is no definitely *fixed* standard length of line used in Model Power Boat Association events.

In the case of the 100-yard lap, the total distance from the centre of the pole to the centre of the boat is 47 ft. 8¾ in. approximately, but out of this must be allowed the length of the attachment at the pole end, and also the tethering bridle of the boat, which, under present Model Power Boat Association regulations, extends 4 ft. from the centre line of the hull.

Several types of electrical timing apparatus are in use, including strip timing chronographs, which have great advantages in providing permanent records of every lap; but a simpler and more reliable apparatus for general use is the electrically-operated stop watch and lap counter.

An article which reviewed the whole subject of electrical timing devices was given in the issue of THE MODEL ENGINEER dated August 16th, 1951. Other articles dealing in more minute detail with their construction have also been published.

Water Pumps

I wish to construct a pump to supply water for my garden from a brook which runs past the end of it. The water is to be lifted some 8 ft. from the brook, and then pumped along a main of ½ in. or ¾ in. steam pipe running the length of the garden, about 160 ft., with taps at intervals to which the hose may be connected. I propose to drive the pump first by hand, but later I hope to build a small internal combustion engine for this purpose. Will you please advise me of any books you can recommend, also bore and stroke of the pump cylinder, suitable materials, and advise as to a suitable engine for its drive in the future.

N.K.W. (Blakeney).

The simplest and most suitable type of pump for the purpose you specify, assuming that it is to be driven by a small internal combustion engine, would be one of the centrifugal type, which could be direct-coupled to the engine shaft and run at fairly high speed.

This, of course, is incompatible with the type of pump which would be most suitable to drive by hand, but in view of the distance that the water has to travel, we think that hand pumping would be found quite laborious. A plunger pump, if driven by an engine, would require reduction gear, which would very much complicate construction and also lower efficiency.

We do not know of any books at present available on the subject of pump construction. In the case of a hand-operated pump, which could presumably be worked at about 60 strokes per minute, we would suggest that a stroke of about 6 in. and a bore of 2 in. would be suitable.

Non-ferrous materials, such as brass or gunmetal, which would not be liable to rust, would be very suitable for constructing the barrel of the pump, and other parts in contact with water.

Any of the small industrial engines made by such firms as R. A. Lister, Dursley, Gloucestershire, Villiers Engineering Co. Ltd., Wolverhampton, or J. A. Prestwich, of London, N.17, would be suitable for work of this nature.

Repairing a Refrigerator Motor

I have a refrigerator of the type having the entire unit in a large cylinder on the top of the cabinet. The motor has developed an electrical leak, and anyone touching it when it is running gets a severe shock.

Notwithstanding the leakage, the machine works perfectly, and refrigerates efficiently. The makers are unable to give me any assistance. Will you please advise me whether it is practicable to open up the container to put the motor right.

C.F.W. (Abbots Leigh).

It is probable that, as you suggest, the condenser of the capacitor-start motor in your refrigerator has broken down, and is leaking to earth. This trouble has been found in several sealed-in types of refrigerators which we have encountered.

It is possible to drain the system of gas, and cut a hole in the casing to get at the motor, but this should be done by someone fully acquainted with the type of apparatus, and with means of recharging the system afterwards.

We understand that Messrs. Braid Bros., of 50, Birchwood Avenue, Hackbridge, Surrey, have had experience in this particular class of work, and may be prepared to give you some assistance and advice on the matter.

Packing Lathe for Shipment

I expect to be emigrating to South Africa within the next few months, and wish to take my Myford M.L.7 lathe with me. Will you please advise me regarding the best method of stripping it down for packing, and to safeguard it from damage and rust on the journey.

J.F.W. (Altrincham).

The method of packing your M.L.7 lathe for overseas transport will depend very largely on the type of receptacle available, but we should be inclined to favour using a large enough case to take the lathe practically complete, with most of its fittings in position, and clamped to prevent movement.

The accessories also can, in most cases, be clamped to the lathe bed, or in any convenient position close to it, in such a way that they cannot move. This is generally better than dismantling the lathe and packing the components separately in loose packing.

To prevent the parts from rusting, a heavy coating of some approved rust-resisting preparation is desirable, but some form of rust inhibiting preparation, such as V.P.I.-coated paper, is now extensively used, and is reported to be entirely satisfactory.

Rod and Tubular Chimes

I wish to construct a set of chiming rods for Whittington chimes, using $\frac{3}{16}$-in. diameter bronze welding rod as described by Mr. C. R. Jones in the September 20th, 1951, issue of the " M.E." The notes required are as follows: D, E, F (sharp), G, A, B, C, D. Will you please advise me what lengths of rod are required to produce these notes?

L.S.P. (c/o G.P.O., London).

From information furnished by Mr. C. R. Jones, the approximate lengths of $\frac{3}{16}$-in. rods required to produce these notes are: $9\frac{1}{2}$ in., $9\frac{7}{8}$ in., $10\frac{1}{2}$ in., 11 in., $11\frac{5}{8}$ in., $12\frac{1}{4}$ in., $12\frac{7}{8}$ in. and $13\frac{5}{8}$ in. respectively. The exact lengths will have to be ascertained by trial, with the aid of a piano or other musical instrument. As described by Mr. Jones, the rods should be tapered down to about half their diameter for a length of 1 in., immediately adjacent to the clamp bar in which they are mounted. For tubular chimes, we may refer you to an article by Mr. A. Ashby in the " M.E." dated July 6th, 1950, in which he gives approximate lengths of $10\frac{1}{2}$ in., 11 in., $11\frac{9}{16}$ in., $12\frac{1}{4}$ in., $12\frac{15}{16}$ in., $13\frac{5}{8}$ in., $14\frac{5}{16}$ in. for brass tubes 1 in. diameter by 16-gauge, each having a stop disc near the upper end and suspended on gut slings.

Carburettor Details

Will you please advise me where to obtain castings for the Atom type " R " carburettor, also the specified materials for the float, and its dimensions?

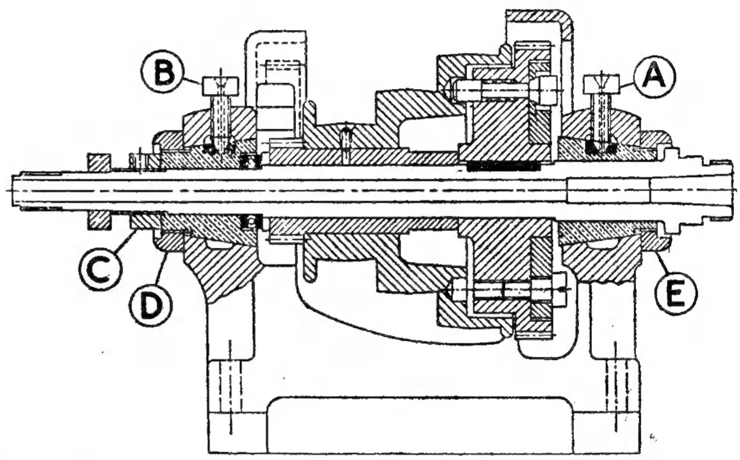
I should also like to know if it is possible to machine the components for the " Busy Bee " 50 c.c. engine on a 3-in. screwcutting lathe.

D.W. (Glenarm, Co. Antrim).

Castings for the Atom type " R " carburettor can be obtained from Craftsmanship Models Ltd., Norfolk Road Works, Ipswich. They are made in two sizes, the smaller for 15 c.c. and the larger for 30 c.c. engines.

Either metal or cork floats can be used, the latter being perfectly satisfactory if well varnished to prevent absorption of fuel. Metal floats are extremely difficult to make satisfactorily in small sizes. The dimensions of the float are $\frac{7}{8}$ in. diameter × $\frac{7}{8}$ in. long.

A 3-in. lathe would be very much on the small side for machining the components of the " Busy Bee," and there might be problems in handling some of the larger components. The work can, however, be carried out quite satisfactorily on a $3\frac{1}{2}$-in. lathe.



Details of Drummond Lathes

I have obtained two Drummond lathes, namely, one of the 4 in. round bed type, and the other of the $3\frac{1}{2}$ in. flat bed type. Both are short of certain components and I wish to obtain details of these to enable me to put the lathes in order. The former lathe is fitted with complete split gunmetal bearings. Can you tell me if it is likely that the headstocks have been planed down, and these bearings fitted, since the lathe was manufactured; also, whether the standard spindle and cone pulley will fit? The $3\frac{1}{2}$ in. lathe has an overarm support cast on the headstock, and a solid spindle and tailstock barrel. Can you furnish me with details and dimensions of the $3\frac{1}{2}$ in. lathe headstock and back gear?

T. A. (Sheffield).

The type of bearing which you described for the 4 in. lathe was used on some of the early lathes of this type. While it is possible that a lathe having solid bearing housing might have been converted, we are rather doubtful whether a satisfactory job could have been made in this way, owing to the difficulty of fitting the holding-down studs, unless the headstock was specially designed to take them.

We cannot give you full dimensions and details of the Drummond $3\frac{1}{2}$ in. flat bed lathe, but you may be able to obtain them from the Myford Engineering Co. Ltd., Neville Works, Beeston, Notts, who have taken over the production of these lathes.

We give here a sectional drawing of a modern type of $3\frac{1}{2}$ in. Drummond lathe headstock, which we believe to be similar to the one in your possession, except that the casting does not incorporate an overarm. The split tapered bushes are adjusted by means of the rings-nuts, *D* and *E*, and the end play adjustment is effected by the screwed collar, *C*. *A* and *B* are combined locking screws and lubricators.

Resistance for Projection

I am building a strip projector using a 115-volt, 1,000-watt projection bulb. This will require a resistance to run off the 240-volt mains, and I would like to use electric fire elements for this. What wattage element would be needed? I do not object to the high temperature of the element, provided that it is not sufficiently high to cause damage.

R.F.W. (Shepperton, Middx.).

The projection bulb referred to, designed for 115 volts, would require a resistance to step down the mains voltage to approximately half its value. Therefore the resistance should be approximately equal in resistance to the bulb itself, but it should be noted that the cold resistance of the bulb will be con-

siderably less than that of its working resistance when hot.

We suggest that an electric fire element capable of absorbing a thousand watts on 120 volts would be suitable, but some degree of adjustment of resistance would be desirable, and this could be done by using a higher resistance element, and fitting a contact clip, which could be clamped in position after adjustment has been obtained.

We may mention that this method of adjusting voltage is extremely wasteful, as approximately half the current would be wasted in heat. A transformer would be a much more efficient method of stepping down the voltage.

Cutting Clock Pinions

I propose to construct an electric clock to one of the designs in your handbook "Electric Clocks and How to Make Them," and shall be obliged if you will inform me whether it is possible to cut the pinions from the solid by planing the teeth out in the lathe, with a tool held on its side in the toolpost. Also, what method is usually employed in finishing the pinion teeth and also the pivots, to obtain the high polish as seen in the best types of clocks?

R. J. (Chalfont).

The method you propose is certainly practicable, if a correctly formed and adjusted cutting tool is employed, and the work is accurately indexed in the number of tooth spaces required. Quite good results have been obtained in this way, but it has disadvantages for the particular purpose described, and is not the method normally adopted by clockmakers. The chief disadvantages in this case are due to the fact that pinions are usually made in semi-hard carbon steel, and the arbors are usually too slender to give rigid support against the heavy side thrust of the planing tool; this could be remedied by cutting the pinion teeth before the arbors are reduced to finished size. A much more common method of cutting pinion teeth is by milling or fly-cutting, which can also be done in the lathe, using methods which are fully described in our handbooks *Milling in the Lathe* and *Gears and Gear-cutting*. Clock pinions and pivots are finished by abrasive polishing processes, including lapping, using progressively finer abrasives as work proceeds, and finally (in the case of the pivots), by burnishing. The technique is fully described in de Carle's *Practical Clock Repairing*, published by N.A.G. Press Ltd., price 30s.

WITH THE CLUBS

Mr. Ramsbottom explains to Mr. Maskelyne how the watchmakers' balance spring-testing tool works

Acton Model Engineering Society

The society held its first competition for members recently; the competition was in two sections, one for members with professional experience and one for amateurs, a cup being presented for each class.

Mr. Maskelyne, Technical Editor of THE MODEL ENGINEER, kindly consented to visit the society and judge the competition. A comprehensive array of models and tools were entered and the cup in the "Professional" class was won by S. Telling with a magnificent 4 ft. model of a 60 ft. diesel cabin cruiser; this was unfinished but shows every promise of being a potential winner for some future "M.E." Exhibition. The cup in the "Amateur" class was won by J. Ramsbottom, with a most unusual and beautifully-finished piece of work, a watchmaker's balance-spring testing tool. The society is very proud of the praise bestowed by Mr. Maskelyne on the general standard of workmanship exhibited by members.

The evening was also a social event; refreshments were available and the society had the pleasure of entertaining quite a few visitors, including a party from their neighbours the West London S.M.E.

For future activities the society hopes to obtain ground for erection of a permanent outdoor locomotive track.

The society's premises and workshop are at 41, Churchfield Road, Acton, London, W.3. (Entrance in the Mews at the back of Churchfield Road.) Visitors are welcome on any Tuesday evening between 7 and 10 p.m.

Particulars of the society may be obtained from the Hon. Secretary, S. J. BOWLES, 27, Twyford Abbey Road, London, N.W.10.

Perranporth and District Model Engineering Society

At the recent annual general meeting of the above society, the election of officers for the ensuing year took place. The retiring chairman, Mr. F. P. Orchard, was re-elected, with Mr. R. Beckton as vice-chairman. Mr. W. J. Baker was re-elected hon. secretary, as was Mr. W. T. Pillar as hon. treasurer.

May we take this opportunity to wish all readers and fellow enthusiasts another happy and successful New Year.

Hon. Secretary: W. J. BAKER, St. Piran's Road, Perranporth.

Sutton Coldfield and North Birmingham Model Engineering Society

The first half of our winter programme ended with a very enjoyable social evening held at the clubroom on December 16th. Our programme for the next three months is as follows:—January 27th. Model Locomotive Building (C. F. Palmer). Feb. 10th. Clocks. (J. James.) Feb. 24th. Fabrication of parts for model engineering. (W. Phillips.)